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DRAFT
Proposed Action Memorandum for the East Trenches Plume

RF/RMRS-98-258.UN

Environmental Restoration
Rocky Flats Environmental Technology Site

December 1998
Revision Draft

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BZ-B-00035

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DRAFT
PROPOSED ACTION MEMORANDUM FOR THE EAST TRENCHES PLUME

December 22, 1998

APPENDIX

TABLES

FIGURES

ACRONYMS

AHA	Activity Hazard Analysis
ALF	Action Level Framework
APEN	Air Pollution Emission Notice
ARAR	Applicable or relevant and appropriate requirement
BMP	Best Management Practice
CCR	Colorado Code of Regulations
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental, Compensation and Liability Act
CFR	Code of Federal Regulations
cm/sec	Centimeters/second
DOE	Department of Energy
EDE	Effective Dose Equivalent
EPA	Environmental Protection Agency
ER	Environmental Restoration
ETI	Envirometal Technologies, Inc.
HASP	Health and Safety Plan
IHSS	Individual Hazardous Substance Site
IT	International Technology Corporation
K-H	Kaiser Hill
LDR	Land Disposal Restrictions
mg/kg	milligram per kilogram
mg/l	milligram per liter
Mrem	millirem
mrem/yr	millirem/year
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollution Discharge Elimination System
PAM	Proposed Action Memorandum
PARCC	Precision, Accuracy, Representativeness, Completeness and Comparability
pCi/g	picoCurie per gram
pCi/l	picoCurie per liter
PPE	Personal Protective Equipment
RACT	Reasonably Available Control Technologies
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RMRS	Rocky Mountain Remediation Services, L.L.C.
TU	Temporary Unit
μg/l	microgram per liter
VOC	Volatile Organic Compound
WARP	Well Abandonment and Replacement Program

1.0 PURPOSE

This Proposed Action Memorandum (PAM) outlines the selected strategy, applicable requirements and implementation schedule for the collection and treatment of contaminated groundwater from the distal end of the East Trenches Plume. The East Trenches Plume is ranked seventh on the 1997 annual update of the Environmental Restoration (ER) Ranking (RFCA Attachment 4, DOE 1996a) and ranks second of the sites not yet remediated.

The East Trenches Plume contains chlorinated organic compounds in excess of Action Level and Standards Framework (ALF) Tier I level concentrations defined in Attachment 5 to the Rocky Flats Cleanup Agreement (RFCA)(DOE 1996a). The proposed action will consist of constructing a subsurface groundwater collection system coupled with a reactive metals treatment system. This system will collect and treat contaminated groundwater from the East Trenches Plume to below RFCA surface water action levels (DOE 1996a).

The project will be conducted in accordance with RFCA, Department of Energy (DOE) Orders and Rocky Flats Environmental Technology Site (RFETS) policies and procedures. Remedial activities performed under this PAM will be consistent with and contribute to the efficient performance of anticipated long-term remedial action for the buffer zone, and will be conducted in a manner which is protective of site workers, the public, and the environment.

2.0 PROJECT DESCRIPTION AND OBJECTIVES

The East Trenches Groundwater Plume is located north of Central Avenue, and east of the East Perimeter Road (Figure 1). This groundwater plume contains volatile organic compound (VOC) contamination believed to originate from the East Trenches and 903 Pad sites and extends northward to where the plume discharges as seeps and subsurface flow into the South Walnut Creek Drainage (RMRS 1996a). Recent exceedances of the Tier II RFCA VOC groundwater action levels in a designated Tier II well near South Walnut Creek, and recent detections of VOCs in the ice-covered B-series ponds indicate that contaminated groundwater is reaching surface water at this location.

Therefore, a downgradient capture system will be installed near South Walnut Creek to intercept VOC-contaminated groundwater. The groundwater will be collected and treated at a centralized treatment location to meet surface water action levels from the ALF (DOE 1996a). The treated water will then be discharged into surface water downgradient of the capture system. The downgradient capture system was chosen as the best remediation method following an evaluation of other more traditional options in the Groundwater Conceptual Plan (RMRS 1996a). A passive, reactive metal treatment system was selected because it effectively treats the existing VOCs to below action levels at lower life-cycle cost than other treatment options. A similar system was recently installed for the Mound Site Plume. The project has the following objectives:

- Intercept and treat VOC-contaminated groundwater at the distal end of the East Trenches' Plume.
- Protect surface water and reduce the VOC-contaminant mass loading in surface water, to the extent practicable.
- Install an easily accessible system to reduce operation and maintenance costs and to easily replace media when necessary.
- Minimize the impact to Preble's Meadow Jumping Mouse during construction.
- Avoid depletion of waters to South Walnut Creek.

2.1 Background

Most of the groundwater contamination is believed to be derived from the East Trenches area (Figure 1) primarily associated with the trenches on the north side of the East Access Road, which include Trenches T-3 (Individual Hazardous Substance Site (IHSS) 110) and T-4 (IHSS 111.1).

Trenches T-3 and T-4 were used between 1964 and 1967 for disposal of sanitary sewage sludge contaminated with low levels of uranium and plutonium, VOCs, crushed drums, and miscellaneous waste (DOE 1992). In 1996, these trenches were excavated as part of an accelerated source removal action. The removed soil and debris were treated by thermal desorption to remove the VOCs, primarily carbon tetrachloride, trichloroethene, and tetrachloroethene. The treated soil below Tier II action levels was returned to the trench excavation and the area was revegetated. Some radiologically contaminated soils between Tier I and Tier II levels were wrapped in geotextile material for ease of future identification and returned to the Trench T-4 excavation (RMRS 1996b).

A component of the plume is also believed to be derived from the VOC contamination at the 903 Pad and Lip Area where drums containing plutonium and uranium contaminated oils and solvents were stored from the summer of 1958 to January 1967 (RMRS 1996a, 1997a). A remedial action is planned to begin in 2001 to remediate the radiologically- and VOC-contaminated soils in this area.

2.2 Recent Investigation Results

Pre-remedial investigations were conducted in the fall 1997 and spring 1998 to determine the extent and configuration of the East Trenches Plume near South Walnut Creek. Geoprobe borings were advanced at the East Trenches plume as part of the RFETS Fiscal Year 97 Well Abandonment and Replacement Program (WARP). Follow-on work was conducted in spring 1998 to collect sufficient data to design a remedial action (IT, 1998).

As a result of the combined investigation, thirty-two geoprobe holes were pushed at approximately 100-foot spacing perpendicular to the plume axis. The geoprobe holes were located along the road near the south bank of South Walnut Creek, above Ponds B-1 and B-2 (Figure 2). Steep topography and wetland areas resulted in some variation of the 100-foot spacing. Two geoprobe holes were pushed away from the primary alignment to obtain information on bedrock elevation, lithology and contaminant chemistry along potential flow paths between the source areas and the creek.

Twenty-five temporary wells were installed in these geoprobe holes to define the nature and extent of contamination in groundwater at the distal end of the plume. For all wells containing sufficient water, water levels were measured and groundwater samples were collected and analyzed for radiological screening and VOCs. Soil samples were collected from several boreholes and analyzed for VOCs and other analytes.

2.3 Geologic Setting

The geologic setting of the East Trenches Plume area, as described in several reports (DOE 1995, EG&G 1995a, EG&G 1995b, RMRS 1996a, IT 1998) and as determined by recent investigations, is as follows. Trench T-3 and T-4 are located at the northern edge of the pediment (Figure 1) where up to 18 feet of Rocky Flats Alluvium overlies weathered claystone and the No. 1 Sandstone of the Arapahoe Formation. Beyond the plume source area, the hillside slopes steeply to the north towards South Walnut Creek. Both the alluvium and the Arapahoe No. 1 Sandstone are truncated by the South Walnut Creek drainage and subcrop beneath the thin cover of colluvium. Numerous slump features are also found on the hillside.

The bedrock surface slopes to the north, generally conforming to the surficial topography (Figure 3). In the source area, the northeast extensions of the bedrock ridge and medial paleoscour further control groundwater flow. Recent borings (including 02597, 02697, and 02797) suggest that, although the ridge extends toward the south trending drainage which enters South Walnut Creek below the B-ponds, the paleoscour is not well developed in this area (Figure 3). An attempt to further define the extension of these features was not successful due to inability of the drilling equipment to penetrate through cobbles in the Rocky Flats Alluvium.

The uppermost bedrock is dominated by fine to medium grained sandstones, often silty or clayey, along the western half of the alignment of borings, from 22597 through 23497. At boreholes 22597, 22697, 22997 and 23097, the Arapahoe No. 1 Sandstone is present, generally overlying less permeable sandstones. The finer grained sandstones are tentatively identified as less permeable units of the Laramie Formation. Claystone was encountered beneath the sandstone units and at the top of the bedrock at locations where sandstone was not present.

At boring 03098, a black carbonaceous material was encountered in claystone at a depth of 13.0 and 13.5 feet and sampled. Two additional wells (03598 and 03698) were completed nearby, and the carbonaceous material was observed at similar depths. The occurrence and associated soil and groundwater chemistry is consistent with naturally occurring carbonaceous material, which is common in the Laramie Formation.

2.3.1 Hydrogeology

Groundwater flow is to the north and northeast with discharge primarily as seeps, springs, and evapotranspiration in the area near South Walnut Creek particularly where the water bearing units are truncated. At a spring and seep complex on the south bank of South Walnut Creek, above Ponds B-1 and B-2, where the Arapahoe No. 1 Sandstone subcrops, concentrations of VOCs above Tier I action levels were detected during a recent sampling event. The presence of VOCs in the seep complex indicates that contaminants have reached South Walnut Creek. Groundwater was encountered in most of the wells installed in 1997 and 1998 along the alignment (Figure 4). Where present, groundwater was found in the colluvium, in the weathered bedrock just below the colluvial/bedrock contact or in the bedrock sandstones. Water levels ranged from 4 feet to 17 feet below ground surface (Table 1). The calculated groundwater flow rate for this plume is approximately 1,013 cubic feet per day (5.3 gallons per minute) with 991 cubic feet per day flow (5.1 gallons per minute) from the Arapahoe No. 1 Sandstone.

Table 1. Depth to Groundwater and Bedrock (in feet)

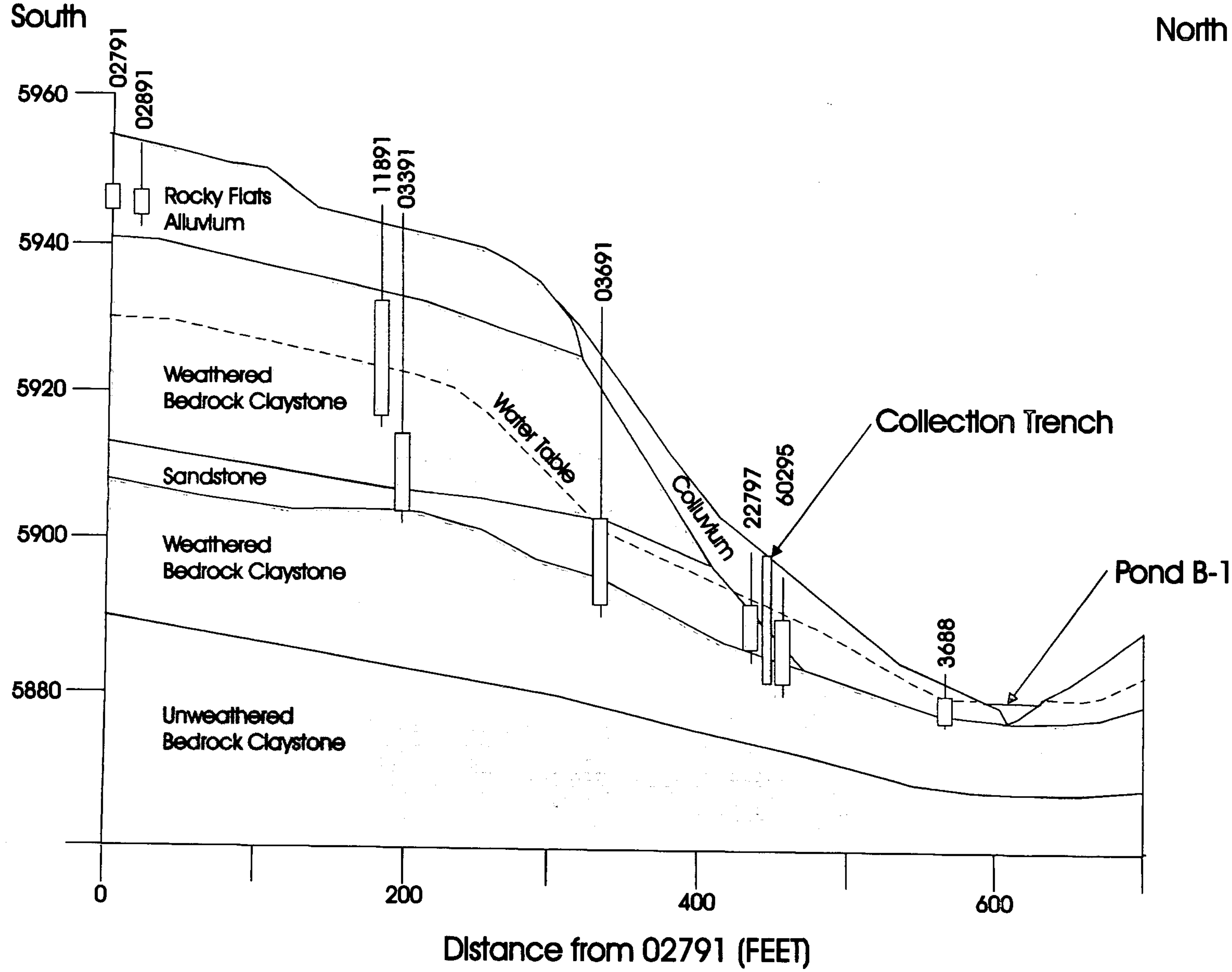
1997 Boreholes	Ground Elevation	Depth to Water	Depth to Bedrock	Total Depth	1998 Boreholes	Ground Elevation	Depth to Water	Depth to Bedrock	Total Depth
22597	5914.0	11.9	0.8	26.2	02398	5909.5	Dry	4.2	10.7
22697	5907.0	8.1	1.9	18.0	02498	5863.5	Dry	12.0	22.0*
22797	5899.0	3.9	8.0	13.8	02598	5855.8	15.3	5.8	22.3*
22897	5897.0	10.3	1.0	24.2	02698	5861.5	16.5	3.4	18.2
22997	5891.0	5.3	5.8	16.1	02798	5865.1	6.8	2.6	14.6*
23097	5887.0	4.9	6.2	13.8	02898	5865.3	8.6	2.0	13.9
23197	5885.0	5.6	4.3	17.3	02998	5926.1	NWI	NA	18.0
23297	5881.0	10.8	9.1	13.3	03098	5875.4	NWI	6.0	14.0
23397	5879.0	10.4	5.5	14.2	03598	5877.9	9.8	4.0	16.2*
23497	5876.0	11.9	2.4	12.4	03698	5879.8	Dry	4.6	15.0
23597	5873.0	11.4	1.6	19.4	03798	5909.0	NWI	4.4	9.7
23697	5871.0	Dry	5.7	11.1	03898	5908.8	NWI	4.0	10.2
23797	5867.0	15.9	17.0	20.2					
23897	5862.0	11.4	12.5	18.3					
23997	5861.0	13.1	8.9	18.1					
24097	5859.0	14.5	5.5	18.2					
24197	5857.0	13.0	8.0	16.1					
24397	5925.0	4.2	4.3	18.5					
24497	5917.0	8.6	5.2	17.1					

* Borehole was backfilled prior to well construction
NWI No well installed at this location

The Arapahoe No. 1 Sandstone is present beneath the East Trenches source area and is a preferential flow pathway for contaminated groundwater to flow towards South Walnut Creek. As shown in the cross section (Figure 5), and as verified during the recent field investigation, the Arapahoe No. 1 Sandstone is present at the distal end of the East Trenches Plume and subcrops into the colluvium in the vicinity of South Walnut Creek, at a seep complex. Much of the groundwater flow and contaminant flux is through the Arapahoe No. 1 Sandstone.

Groundwater is also transmitted through the Valley Fill Alluvium that underlies South Walnut Creek, with groundwater flow influenced by the earthen dams. Figure 6 illustrates the cross section along South Walnut Creek in the project area. Typically the thickness of the Valley Fill Alluvium near the B-series ponds is 5.5 to 10.5 feet thick and is narrowly confined (20 to 250 feet wide upstream of Pond B-5). Saturated thickness ranges from 5 to 10 feet, but it is not known whether the alluvium is continuously saturated between the dams. Recharge of the alluvium is from direct infiltration of precipitation, and seepage from ponds and South Walnut

Figure 5. Generalized Hydrogeologic Cross Section for the East Trenches Plume



99-0040/fig5_xsect_east-trench.cdr

Creek (DOE 1996b). In addition, contaminated groundwater from the East Trenches Plume directly discharges into the Valley Fill Alluvium which may act as a preferential pathway for transport of the contaminated groundwater.

Four wells along the alignment were dry. Three of these wells, 23697, 03698 and 02498 were installed in the claystone bedrock (Figure 4). Well 02398 was also dry. It is located approximately 200 feet southeast of well 23097, where bedrock consists of weathered, fine-grained, clayey sandstone overlying silty claystone (Figure 2). However, the well was installed at a shallow depth due to refusal of the drilling equipment, and it is probable that, at this location, groundwater occurs at a greater depth.

The horizontal hydraulic gradient in the vicinity of the well alignment is approximately 0.14 in a northerly direction. Hydraulic conductivity ranges and geometric means for the hydrogeologic units were derived from sitewide data (EG&G, 1995b) and are considered representative of the hydrogeology of the East Trenches plume study area:

- Colluvium - 4.0×10^{-6} to 9.3×10^{-4} centimeters/second (cm/sec), with a geometric mean of 9.3×10^{-5} cm/sec.
- Weathered Arapahoe/Laramie claystone - 3.0×10^{-8} to 5.6×10^{-4} cm/sec, geometric mean of 9.98×10^{-7} cm/sec.
- Weathered Arapahoe/Laramie sandstones other than Arapahoe No. 1 sandstone - 5.7×10^{-6} to 2.1×10^{-4} cm/sec, geometric mean of 3.9×10^{-5}.
- Weathered Arapahoe No. 1 Sandstone - 4.0×10^{-5} to 9.3×10^{-3} cm/sec, geometric mean of 7.9×10^{-4} cm/sec.

2.4 East Trenches Plume Contamination Data Summary

The primary contaminants in the East Trenches groundwater plume are VOCs derived from the Trench 3 and Trench 4 source areas (Figure 1). VOC contamination has been observed in the groundwater and in seeps at South Walnut Creek, but not in the subsurface soil. Radiological contamination was not observed in either the subsurface soils or in groundwater. In the source area, semi-volatiles, petroleum compounds, and uranium-238 (at concentrations up to 3,240 picocuries/gram (pCi/g) were also detected (RMRS, 1996b).

2.4.1 Groundwater

Groundwater samples were collected during September and October 1997 for wells 22597 to 24497, and in May and June 1998 for wells 02598 to 02898 and 03598. Trichloroethene was the predominant contaminant found in groundwater at the distal end of the East Trenches Plume with the highest concentration of 6,800 micrograms/liter (μg/l) in Well 23197. Other constituents found include: 1,1,-trichloroethane at 730 μg/l in well 22697, and carbon tetrachloride at 460 μg/l in well 22997. Table 2 summarizes the groundwater results of this investigation.

Table 2. Groundwater Volatile Organic Compound Concentrations (in μg/l)

Well	Trichloro-ethene	Tetrachloro-ethene	Carbon Tetrachloride	1,1-Dichloro-ethene	Toluene	Chloro-Form	Methylene chloride
22597	1	250	12	1 U	1 U	1 U	1 U
22697	41	730	71	1 U	1 U	1 U	1 U
22797	36	580	95	1 U	1 U	1 U	1 U
22897	11	83	20	1 U	1 U	1 U	1 U
22997	280	440	460	9	1 U	1 U	1 U
23097	2600	320	280	1 U	1 U	1 U	1 U
23197	6800	190	140	1 U	1 U	1 U	1 U
23297	Dry	Dry	Dry	Dry	Dry	Dry	Dry
23397	560	37	69	1 U	1 U	1 U	1 U
23497	Dry	Dry	Dry	Dry	Dry	Dry	Dry
23597	370	17	64	1 U	1 U	1 U	1 U
23697	Dry	Dry	Dry	Dry	Dry	Dry	Dry
23797	Dry	Dry	Dry	Dry	Dry	Dry	Dry
23897	1	1	8	1 U	1 U	1 U	1 U
23997	0.7	0.4	4	1 U	1 U	1 U	1 U
24097	Dry	Dry	Dry	Dry	Dry	Dry	Dry
24197	Dry	Dry	Dry	Dry	Dry	Dry	Dry
24297	22	210	110	1 U	1 U	1 U	1 U
24397	1 U	31	1 U	1 U	1 U	1 U	1 U
24497	0.6	17	0.7	1 U	1 U	1 U	1 U
02598	5 U	5 U	5 U	5 U	5 U	1 J	6
02698	5 U	5 U	5 U	5 U	5 U	1 J	3 J
02798	5 U	5 U	5 U	5 U	5 U	5 U	5 U
02898	5 U	5 U	5 U	5 U	5 U	5 U	5 U
03598	5 U	5 U	5 U	5 U	2 J	5 U	5 U

Table includes only compounds which were detected in one or more of the samples
Dry indicates that the well was dry or had insufficient water for analysis of VOCs.
U indicates that the contaminant was not detected at the detection limit
J indicates that the contaminant was detected below the detection limit

The trichloroethene concentrations in groundwater are shown on Figure 7. This data demonstrates that the East Trenches are the source of the groundwater plume, and this area contains the highest concentrations. Trichloroethene concentrations are shown to decrease towards the distal end of the plume, however, high concentrations are still present near the stream. The highest concentrations are seen where the Arapahoe No. 1 Sandstone is present in the subsurface, confirming that this unit is a preferential pathway for contaminant flow.

Preliminary modeling results for the East Trenches Plume show that the plume continues to move toward the proposed collection system location and surface water for many years, including past the time of Site closure. However because of the source removal at Trenches T3 and T4, the groundwater contaminant concentrations are expected to increase only slightly at the proposed collection system, then remain almost constant for at least the time period modeled, which is 70 years from the present.

While the East Trenches groundwater contaminant plume is not currently causing exceedances at the points of evaluation or point of compliance, compliance cannot be assured after Site closure due to the need to meet action levels everywhere throughout the stream, possible changes in the volume of water in the South Walnut Creek, and potential changes in the water management within the Creek. As the Valley Fill Alluvium is a preferential pathway for contaminated groundwater to move towards the Site Boundary, these changes may result in future exceedances.

The Actinide Migration Studies at RFETS have shown that movement of plutonium and americium occurs mainly in the particulate phase, and therefore, these analytes are not expected to be seen in groundwater (Honeyman and Santshi, 1997). In addition, recent data collected for the Solar Ponds Plume indicate that anthropogenic uranium has not moved appreciably from the source in that area (RMRS, in progress).

Radionuclide concentrations in East Trenches Plume groundwater are below background concentrations. The wells are shown on Figure 2 and data are provided in Table 3. Uranium 233/234 and uranium 238 concentrations in all of the wells are above the Groundwater ALF Tier II values, but considerably below background concentrations (DOE 1996a). The maximum concentration of plutonium in well 3791 is slightly above the action level, however, the average value for this well is well below the action levels. The maximum concentration (collected in March 1992) is four times higher than any other value from this location. The duplicate from the same date contained 0.0381 pCi/l plutonium. Therefore, the maximum concentration is not considered representative of the groundwater, and is apparently an outlier. Therefore, plutonium is not considered a contaminant of concern.

Table 3. Radionuclide Concentrations in East Trenches Plume Groundwater (in pCi/l)

		Well 3691	Well 3791	Well 11691	Well 12491	Groundwater Background (filtered)*	Groundwater Tier II ALF
Uranium 233/234 pCi/g	Min	2.557	2.171	2.577	1.423	61.62	1.06
	Max	4.28612	4.4	10.7564	6.004		
	Avg	3.19857	2.780	4.6339	2.784		
Uranium 235 pCi/g	Min	-0.0039	0.04313	-0.0189	0	1.82	1.01
	Max	0.50475	0.36437	1.16163	0.44449		
	Avg	0.15589	0.12183	0.3879	0.08516		
Uranium 238 pCi/g	Min	1.751	1.032	2.826	0.7941	42.51	0.768
	Max	3.6	2.6	5.23888	3.209		
	Avg	2.497	1.624	3.5206	1.3841		
Plutonium 239/240 pCi/g	Min	0	0	-0.0004	0	0.05	0.15
	Max	0.03467	0.1635	0.013	0.05366		
	Avg	0.00661	0.0199	0.0048	0.01036		
Americium 241 pCi/g	Min	0	0	0.00099	0	0.04	0.145
	Max	0.032	0.0234	0.012	0.0298		
	Avg	0.01107	0.0087	0.00510	0.0082		

* Background concentrations are from the Draft Background Comparison for Radionuclides in Groundwater (RMRS 1997b).

2.4.2 Subsurface Soil

During the 1998 investigation, subsurface soil samples were collected and analyzed for VOCs, metals and radionuclides. With the exception of two samples with detects of acetone at 9 µg/l at 02598 and 02798, all VOC analyses were below the detection limits. All subsurface soil samples were well below the RFCA action levels for subsurface soils. Metal and radionuclide analytical results are presented below in Table 4 with the locations shown on Figure 2.

Data from previous investigations were used to confirm that radionuclides are not contaminants of concern for the East Trenches Plume. Radionuclide analytical results are shown in Table 4. Results from the boreholes located downgradient of the East Trenches Plume source area (Figure 7), were well below the ALF Subsurface Soil Tier II levels (DOE 1996a). Borehole 10291 is immediately adjacent to Trench T4 in the East Trenches source area and the maximum value observed for uranium 238 at this location slightly exceeds the ALF Subsurface Soil Tier II levels (observed value of 113.1 pCi/g versus action level value of 103 pCi/g). This borehole is located over 400 feet south of the proposed location of the collection and treatment system.

Table 4. Soil Sample Results by Borehole (in milligrams/kilogram (mg/kg) unless otherwise indicated)

Recent Boreholes	**02398**	**02498**	**02598**	**02698**	**02798**	**02898**	**03098**	**03598**	**03698**
Silver	0.11 U	0.14 U	0.05 U	0.05 U	0.05 U	0.06 U	1.0 U	0.11 U	0.10 U
Aluminum	2,730	9,880	8,950	7,810	4,400	6,640	6,560	3,260	4,740
Arsenic	11.0	3.1	6.7	3.2	7.1	3.4	11.6	9.4	2.7
Barium	36.9	82.1	38.1	81.6	51.4	71.4	53.2	32.8	43.9
Beryllium	0.26	0.88	0.61	1.2	0.78	0.42	0.59	0.47	0.95
Calcium	1,490	5,720	1,950	3,300	2,260	4,450	2,410	176,000	3,780
Cadmium	0.13	0.42	0.15	1.7	0.52	0.15	0.34	3.6	0.32
Cobalt	3.1	5.6	4.2	12.4	22.5	3.9	12.0	28.9	5.7
Chromium	3.6	11.7	8.9	8.8	5.1	8.8	8.4	2.5	5.4
Copper	6.8	24	8.2	18.3	7.5	7.1	17.9	6.1	12.2
Iron	5,930	11,100	10,600	41,300	6,910	8,370	14,500	6,340	2,750
Potassium	537	1,670	1,090	1,090	568	845	1,010	435	674
Lithium	1.3 U	12.6	4.9	6.5	5.7	4.7	NA	2.0	2.5
Magnesium	617	3,220	1,670	1,820	899	1,290	1,510	1,670	1,230
Manganese	38.7	81.3	130	664	338	173	100	527	17.7
Molybdenum	0.71	1.4	1.4	0.83	1.1	0.84	0.66	0.52	0.29
Sodium	43	300	904	782	828	617	859	62.7	73.3
Nickel	6.1	16.3	9.7	53.8	26.6	9.6	17.5	8.9	9.4
Lead	6.4	21.2	9.2	12.7	8.7	7.0	15.8	8.9	13.5
Antimony	0.39 U	0.51 U	0.15 U	0.14 U	0.44	0.17 U	0.17 U	0.41 U	0.36 U
Selenium	0.39 U	0.82	0.30	0.83	0.14 U	0.17 U	0.42	0.41 U	0.36 U
Tin	0.44 U	1.6	1.4	1.7	1.2	1.5	1.6	0.45 U	0.87
Strontium	17.6	101	32.5	63.4	30.1	30.1	55.1	58.7	29.5
Thallium	0.48 U	1.5	0.46	0.74	0.22	0.16 U	0.43	0.57	0.44 U
Vanadium	10.2	30.6	20.3	29.4	21.9	18.2	25.3	6.4	8.5
Zinc	21.4	59.6	33.7	93.7	31.5	25.2	68.2	49	44.9
Uranium 233/234 pCi/g	3.9 U*	5 U*	NA	NA	NA	0.465	0.877	5.6*	3.6*
Uranium 235 pCi/g	NA	NA	NA	NA	NA	0.014	0.063	NA	NA
Uranium 238 pCi/g	NA	NA	NA	NA	NA	0.591	0.998	NA	NA
Plutonium 239/240 pCi/g	NA	NA	NA	NA	NA	0.003	0.012	NA	NA
Americium 241 pCi/g	NA	NA	NA	NA	NA	0.008	0.469	NA	NA
Additional Locations		**24193**	**10291**	**10391**	**10991**	**4087**	**4187**	**4287**	**ALF**
Uranium 233/234 pCi/g	Min. Max.	0.0042 3.9335	0.4494 191.7	0.455 0.9664	0.4856 3.429	NA	0.43 0.94	0.32 0.86	307**
Uranium 235 pCi/g	Min. Max		0.00832 11.5	-0.0020 0.04915	0.00402 0.11	NA	NA	NA	24
Uranium 238 pCi/g	Min. Max		0.543 113.1	0.5339 1.089	0.4104 1	0.48 0.63	0.49 0.9	0.33 0.87	103
Plutonium 239/240 pCi/g	Min. Max	0.0007 3.9335	0.00314 15.12	0.00803 3.112	0 0.3455	-0.03 0.07	-0.02 0.17	0 0.18	252
Americium 241 pCi/g	Min. Max	0.0021 0.0399	0 3.293	0.00649 0.4725	0 0.05446	-0.04 0.12	-0.01 0.06	0 0.08	38

NA - no analysis was performed for the specified parameter
U - the analyte was not detected at the detection limit
* Uranium (total) in mg/kg
** Uranium 234 value

2.4.3 Surface Water

Seep samples were collected in February 1997 in the area where the Arapahoe No. 1 Sandstone subcrops into the colluvium in the vicinity South Walnut Creek, into a seep complex. These samples were analyzed for VOCs and the results are show below. The sample locations are shown on Figure 8 with the results shown below.

Table 5. Surface Water Sampling Results (in ug/l)

Sample Location	Sample Type	Sample Date	cis 1,2 Dichloro-ethene	Methylene Chloride	Chloro-form	Carbon Tetra-chloride	Trichloro-ethene	1,1-dichloro-ethene	Tetra-chloro-ethene
60195	Seep Piezometer	7/6/95	U	U	4	30	30	2	510
60295	Seep Piezometer	7/6/95	U	U	13	120	23	U	190
60395	Seep Piezometer	7/7/95	U	U	5	U	U	U	30
GS10	Surface Water	2/13/98	U	U	U	U	U	U	U
B1-001	Pond B1(west)	2/13/98	U	U	U	U	U	U	U
B1-002	Pond B1(middle)	2/13/98	U	U	U	U	U	U	U
B1-003	Pond B1(east)	2/13/98	U	U	U	U	U	U	U
B2-001	Pond B2(west)	2/16/98	94	U	12	16	420	U	16
B2-002	Pond B2 (Middle)	2/16/98	100	U	14	18	400	U	16
B2-003	Pond B2(east)	2/16/98	100	U	14	19	410	U	16
WC-Culvert	Bypass Culvert	2/16/98	1	U	2	8	52	U	8
SW00198	B1 Seep	2/17/98	4	U	1	13	14	U	280
SW00298	B2 Seep	2/17/98	32	U	30	98	970	5	120

U - the analyte was not detected at the detection limit

3.0 PROJECT APPROACH

A downgradient capture system will be installed near South Walnut Creek to intercept contaminated groundwater. A subsurface groundwater collection system will be coupled with a passive reactive metals treatment system to treat the VOC-contaminated groundwater from the East Trenches Plume to below the surface water action level specified in the ALF (DOE 1996a). The downgradient capture system was chosen as the best remediation method following an evaluation of other more traditional options in the Groundwater Conceptual Plan (RMRS 1996a). The passive treatment system was selected because it effectively treats the existing VOCs to below action levels at lower life-cycle cost than other treatment options.

3.1 Proposed Action

The East Trenches Plume contains chlorinated organic compounds above ALF Tier I concentrations. An impermeable barrier groundwater collection system will be keyed into the underlying claystone for flow cut-off, and the collected groundwater will be treated in a separate treatment system (Figure 8). Based on the available data, to capture the contaminant plume, a groundwater collection system will be installed that extends from well 24497 approximately 1,200 feet to the east (Figures 7 and 8). An analysis of the alternatives considered prior to selection of this remedy is found in Appendix A.

The variable elevation of the bedrock surface and the similarity between the clay-rich colluvium and bedrock make it difficult to install a collection system keyed into bedrock at a certain depth. However, because the clay-rich colluvium and bedrock have similar hydrogeologic properties, effective collection of the contaminated groundwater is not dependent on being keyed into bedrock. Therefore, the collection system will be installed at a variable depth of approximately 16 to 26 feet across the site, at least 6 inches, and on average, 3 feet into claystone, without regard to whether this is colluvium or bedrock (Figure 8).

A collection sump will be installed at the eastern end of the collection system to accumulate the groundwater, and to allow fine-grained sediment to drop out. The collected groundwater will then flow by gravity out of the collection system into a series of cells containing reactive iron filings, which will remove the VOCs. Under normal operations, the treated water is expected to discharge to groundwater using an infiltration gallery located adjacent to South Walnut Creek. However, for additional flexibility, the system will be designed to allow discharge directly to surface water in South Walnut Creek, if needed. After installation of the collection and treatment system, reclamation of the disturbed areas will be performed.

3.1.1 Installation of the Collection and Treatment System

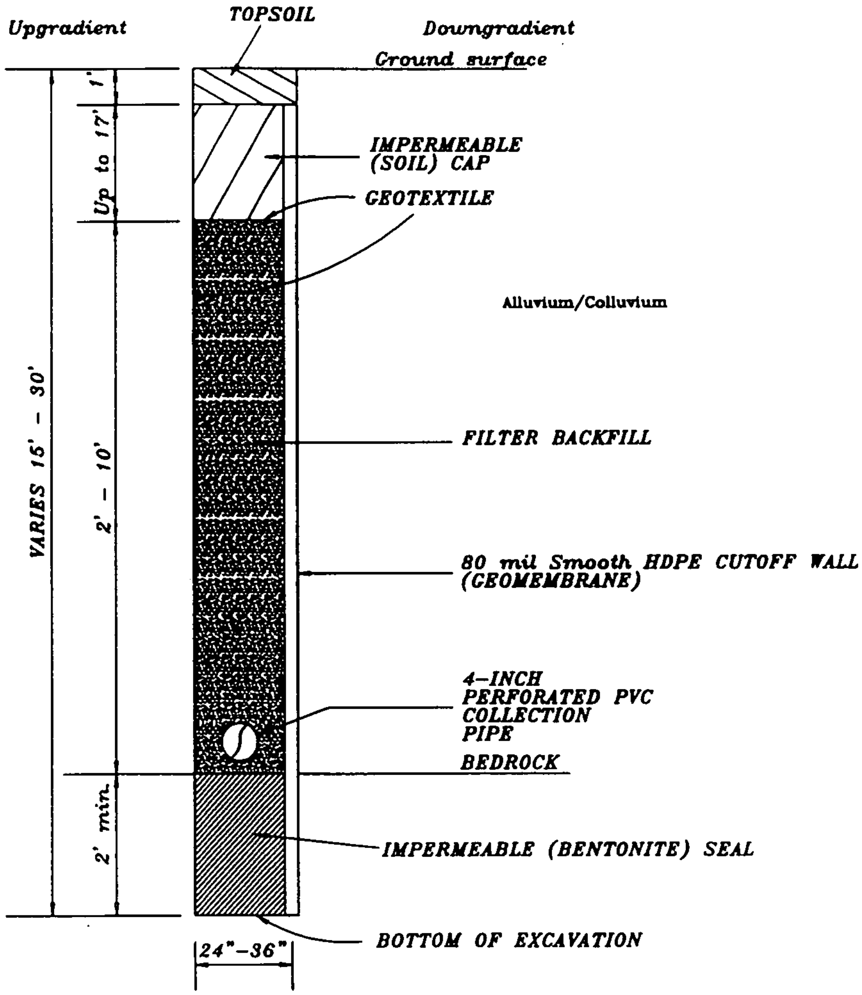
Conventional excavation and/or trenching techniques or a continuous trencher will be used to install the collection and treatment system. Silt fences will be installed downgradient of the excavation to control potential release of sediment to the drainages. During trench construction, the material removed from the trench will be stockpiled adjacent to the trench. A horizontal groundwater-collection line will be installed on the upgradient side of the impermeable barrier. Filter pack will be emplaced around and several feet above the horizontal collection line. The trench will then be backfilled and excess fill will be spread over the top of the collection system. Figure 9 shows the details of the trench construction. An infiltration gallery will be installed downgradient of the treatment cells for subsurface release of the treated groundwater. A pipeline will also be installed to allow direct discharge to the creek as necessary.

During soil handling activities that result in dust generation, dust minimization techniques, such as water sprays, will be used to minimize suspension of particulates. In addition, excavation operations will not be conducted during periods of sustained high winds. The RFETS Environmental Restoration Field Operations Procedure FO.01 - Air Monitoring and Dust Control will be followed.

As neither the soil nor the groundwater in the East Trenches Plume area are radiologically contaminated, no radiological sampling will be required. All equipment will be monitored prior to leaving the site, and work will be evaluated during the project to determine whether radiological monitoring is required. All monitoring will be in accordance with 10 CFR 835 and the RFETS Radiological Controls Manual (K-H, 1996). If unexpected hazards or conditions are encountered during remediation, work will be halted in order to re-evaluate the existing procedures to ensure that these are safe and appropriate.

3.1.2 Treatment and Discharge

A reactive metals treatment system will be used to degrade dissolved VOCs from groundwater. The system will utilize iron to induce conditions where hydrogen is substituted for chlorine in the chlorinated VOCs. The end products of the process are completely dehalogenated hydrocarbons and non-toxic salts. Examples of end products are ethene, ethane, and chloride ions. No chloride salts precipitate as the chloride is released into solution as chloride ions. The amount of chloride ions released is close to the amount of VOC degraded, i.e., for every milligram/liter (mg/l) of volatile organic compounds, the chloride increase in solution will be about one mg/l. This increase in chloride does not pose a problem. The iron released into solution from the corrosion of the metal (as Fe^{++} or ferrous iron) precipitates in the media as an



TYPICAL TRENCH CROSS SECTION

NOT TO SCALE

99-0040/fig8_collection.dwg

Figure 9

Collection Trench Details

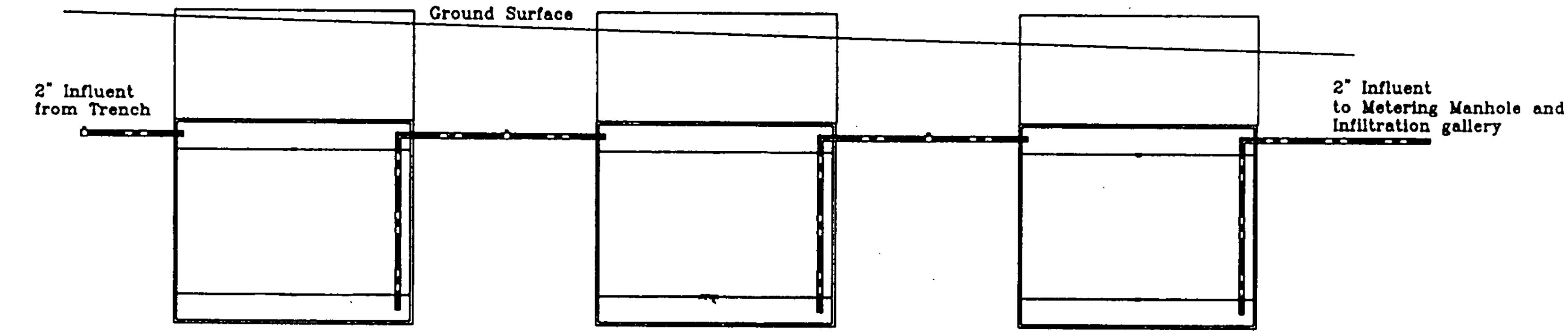
iron oxyhydroxide or iron carbonate. From all field evidence, little to no iron leaches out into the downgradient aquifer (personal communication with John Vogan - ETI, October 1998).

The treatment system will be designed based on the results of laboratory treatability studies previously conducted by Envirometal Technologies, Inc. (ETI), the patent holder for the reactive iron filings technology. The flow rate of 1,013 cubic feet per day (7,575 gallons per day) was used along with a total calculated VOC flux to surface water of 5.2 grams per day. As noted in Section 2.3.1, most of the VOC flux to surface water is from the Arapahoe No. 1 Sandstone. Based on the treatability study results, ETI will recommend the volume of reactive media and retention times required to meet the surface water action levels. A schematic of the treatment system is shown on Figure 10.

The laboratory treatability study used uncontaminated groundwater from RFETS spiked with the maximum contaminants levels expected for the Mound Site, 903 Pad/Ryan's Pit and East Trenches Plumes. Initial concentrations used in the column testing and concentrations in the treated effluent are shown in Table 6. With the exception of methylene chloride, all VOCs were reduced to below surface water action levels. However, the concentrations of methylene chloride in the East Trenches Plume are already very low (Table 2), and surface water action levels are expected to be met.

Table 6. Results of ETI Bench Scale Testing - Connelly Iron

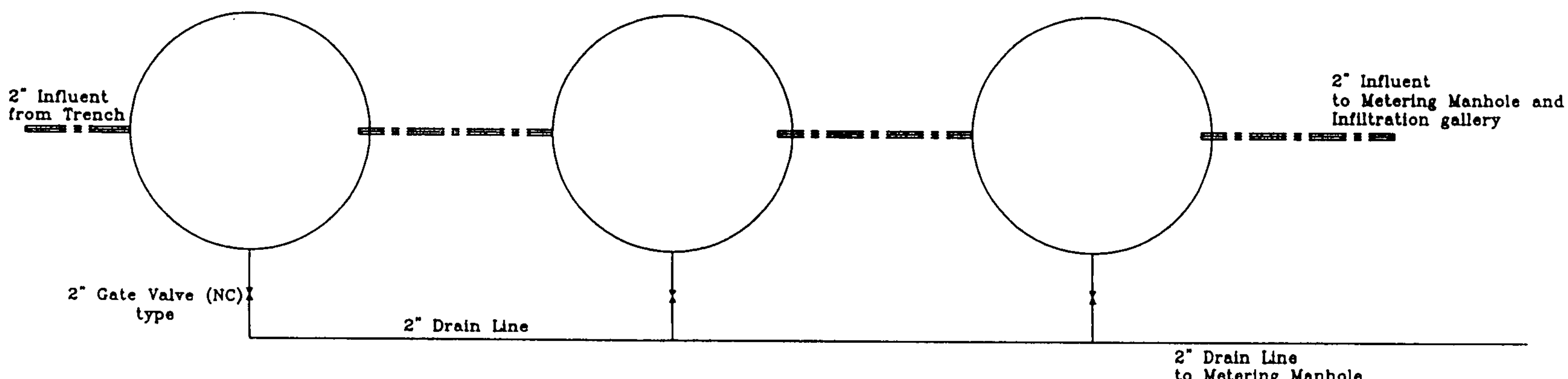
Compound	Influent Concentration (µg/l)	Effluent Concentration (µg/l)	Surface Water Action Level (µg/l)
Carbon Tetrachloride	1,004	not detected	5
Trichloromethane	110	not detected	8
Methylene Chloride	111	105	5
Tetrachloroethene	5,496	not detected	5
Trichloroethene	5,250	not detected	5
Cis-1,2-dichloroethene	64	not detected	70
1,1-Dichloroethene	318	not detected	7
Vinyl Chloride	102	not detected	2
1,1,1-Trichloroethane	37	not detected	200



Treatment System Profile

SCALE: .5 INCH = 1 FOOT

Notes:
Reactors contain a one foot flooded headspace, five feet of iron media, and a one foot drainage layer.



Treatment System Plan View

SCALE: .5 INCH = 1 FOOT

Notes:
Two inch drain lines provide a means to initially fill the reactors from the bottom as well as allow draining of the units for media replacement

Figure 10
Treatment Cell Schematic

3.1.3 Performance Monitoring System

The objective of performance monitoring is to demonstrate the effectiveness of the system. Both the effectiveness of the groundwater interception system, and the treatment system will be monitored. Long term monitoring requirements will be established as part of the Buffer Zone Operable Unit Corrective Action Decision/Record of Decision.

3.1.3.1 Groundwater Monitoring

Monitoring the elevation of the water table in piezometers and downgradient wells will assess the effectiveness of the groundwater collection system. Four piezometers will be installed upgradient of the containment wall to measure water levels within the collection system. Placement of piezometers is detailed in design drawings and these are expected to be equidistant throughout the trench. The Site's Integrated Monitoring Program will be amended to add four downgradient monitoring wells to evaluate the effectiveness of the collection system at capturing the contaminated groundwater plume. These wells are shown on Figure 7, and the sampling frequencies are listed in Table 7.

Table 7. Schedule for Water Quality Sampling and Water Level Measurements

Task	Month 1	Months 2-6	Months 7-12	Subsequent Years
Treatment System Influent	Monthly	Monthly	Monthly	Semi-Annually
Treatment System Effluent	Monthly	Monthly	Quarterly	Semi-Annually
Downgradient Water Quality	Quarterly	Quarterly	Quarterly	Semi-Annually
Hydraulic Head	Monthly	Monthly	Quarterly	Semi-Annually

After sufficient data are gathered to demonstrate stable conditions, the requirements may be changed to annual or less frequent monitoring.

3.1.3.2 Treatment Monitoring

The effectiveness of dehalogenating chlorinated VOCs in groundwater using iron filings will be evaluated by comparing VOC concentrations in water entering and leaving the treatment system. One access point will be installed to allow sampling inflow to the treatment system. A second access point will be installed to allow sampling of the treatment system effluent. A flow indicating device will also be installed in the treatment system discharge line to monitor the volume of treated water. Sampling type and frequency are listed in Table 7.

3.1.3.3 Laboratory Methods

VOC samples will be analyzed by Environmental Protection Agency (EPA) Method 8260. A data usability assessment will be performed for the PARCC parameters (precision, accuracy, representativeness, completeness and comparability) prior to use. The Site will evaluate at least 25% of all data, which may or may not include project data. Data will be reported to the regulators quarterly the first year then annually thereafter. Reporting frequency may be reduced with the concurrence of the regulators if experience warrants.

3.1.4 Site Reclamation

At the completion of the installation of the collection and treatment system, the areas disturbed during construction will be revegetated. Prior to release from RFETS, the equipment will be assessed in accordance with the RFETS Radiological Control Manual (K-H 1996). Excavation equipment will be decontaminated. Typical decontamination methods include pressure washing and hand washing. Revegetation will be in accordance with Site guidelines.

3.2 Worker Health and Safety

A Site-Specific Health and Safety Plan (HASP) will be developed to address the safety and health hazards of each phase of project operations and to specify the requirements and procedures for employee protection. The Occupational Safety and Health Administration construction standard for Hazardous Waste Operations and Emergency Response, 29 Code of Federal Regulations (CFR) 1926.65 will be used as the basis for the HASP. In addition, DOE Order 5480.9A, Construction Project Safety and Health Management, applies to this project. This order requires preparation of Activity Hazard Analyses (AHAs) to identify each task, hazards associated with each task, and controls necessary to eliminate or mitigate the hazards. The AHAs will be included in the HASP.

This project could potentially expose workers to physical, chemical, and low levels of radiological hazards. The physical hazards include those associated with excavation activities, use of heavy equipment, noise, heat stress, cold stress, and work on uneven surfaces. Physical hazards will be mitigated by appropriate use of personal protective equipment (PPE), engineering, and administrative controls. Chemical hazards will be mitigated by the use of PPE and administrative controls. Appropriate skin and respiratory PPE will be worn throughout the project. Routine VOC monitoring will be conducted with an organic vapor monitor for any employees who must work near the contaminated soil (i.e., soil sampling or excavation personnel). Based on employee exposure evaluations, the Site Health and Safety Officer may downgrade personal protective equipment requirements, if appropriate.

Since this is not a radiological area, continuous radiological controls are not expected to be required. However, the HASP will include project "hold points," which will account for unanticipated hazards such as contaminated debris. Radiation monitoring will be included as appropriate to meet this approach in the HASP per the RFETS Radiological Controls Manual (K-H, 1996).

If field conditions vary from the planned approach, an AHA will be prepared for the new conditions, and work will proceed according to the appropriate control measures. Data and controls will be continually evaluated. Field radiological screening will be conducted using radiological instruments appropriate to detect surface contamination and airborne radioactivity. As required by 10 CFR 835, Radiation Protection of Occupational Workers, applicable RFETS implementing procedures will be followed to insure protection of the workers, co-located workers, the public, and the environment. The HASP will describe the air monitoring equipment and methods to be used to monitor for VOCs, particulates, and radiation. Finally, dust minimization techniques will be used to minimize suspension of contaminated soils.

3.3 Waste Management

When the excavation for the placement of the impermeable barrier is performed, soil will be stockpiled adjacent to the trench for use as backfill or to regrade or revegetate the area. If water accumulates in the trench during excavation and poses a threat to the excavation progress, the water will be collected and pumped to a tank or tanker truck for treatment in the Consolidated

Water Treatment Facility. Any associated collected sediment will be segregated, mixed with backfill material to make it more manageable for handling, and returned to the trench.

The treatment system will contain reactive iron that has a limited life and will need replacement during the operational life of the system. When the treatment capacity of the iron is exceeded, the iron will be removed. The spent iron will be stored and managed based on analytical results, and if possible will be recycled and sold as scrap metal. It is anticipated that the iron filings will require replacement every five to ten years.

4.0 ENVIRONMENTAL EVALUATION

RFCA mandates incorporation of environmental evaluation into decision documents such as this Proposed Action Memorandum (DOE 1996a). Accordingly, this section provides a description of potential environmental impacts which may be associated with the remediation of groundwater associated with the East Trenches Plume Site.

4.1 Soils and Geology

Conventional excavation and or trenching techniques are to be used to install the funnel and gate system. The collection system could be as long as 1,200 feet. The width of the collection system will be 24"-36". The collection system will be installed at a variable depth of 16'-26' across the site, and will extend an average of 3 feet into claystone colluvium or bedrock. The collection system will be placed parallel to and beneath the access road to the B-Series Ponds. Construction of the treatment system will disturb surface and subsurface soils in an area approximately 64 feet long, by 16 feet wide and 16 feet deep. The treatment system will be located below ground between Ponds B-3 and B-4. Surface and subsurface soils will be disturbed for the length and width of the excavation sites. The natural soil profile will be eliminated and replaced by a more homogenous soil mixture when the excavated material is backfilled into the trench. Backfilling of the excavations could affect the ability of the disturbed area to support revegetation unless suitable topsoil is used. Topsoil will be segregated at the start of the excavation for later use and improved (e.g. blended with mulch and fertilizer) by Site ecologists, in accordance with Site revegetation procedures. If necessary, additional topsoil will be imported.

The construction area contains slump features that may be easily eroded during construction. Excavated and in-place soils could also be carried off by storm water during the project. However, best management practices such as the downgradient installation of silt fences and hay bales will be used at the work site to prevent the transport of sediment during construction. Revegetation will provide erosion control after installation is complete.

Analysis of subsurface soil samples in the proposed construction area revealed VOCs, metals, and radionuclides below detection limits, with the exception of two samples where acetone was detected. Radiological monitoring of the soil will not be performed unless it is required to protect workers, the public, and the environment in accordance with 10 CFR 835 and the RFETS Radiological Controls Manual. During excavation, soils will be stockpiled adjacent to the trench or benched within the excavation for eventual use as backfill. All excavated soils will be returned to the excavation during backfill operations.

4.2 Air Quality

Project activities potentially could generate criteria air pollutants and radionuclides. The criteria pollutant of greatest concern is dust, specifically particulate matter less than ten microns in size (PM10). An air quality analysis will be performed to assure compliance with applicable air quality regulations. The analysis, along with other project information, will identify appropriate measures to take to protect the health of workers and the public. Such measures, if necessary, will be identified in the project's HASP.

Dust from construction will be the primary non-radiological air emission. The Colorado Air Quality Control Commission requires that practical, economically reasonable, and technologically feasible work practices be used to control emissions. Techniques such as using water sprays and stopping work during high wind periods (typically winds exceeding 15 mph) will be used. If fossil-fuel fired generators or other portable equipment will be needed, opacity standards (20 percent) must be met and fuel usage tracked for the duration of the project. Heavy equipment (e.g., trenchers, bulldozers, front-end loaders and dump trucks) will be used. The impact from heavy equipment and from the construction of the trench itself are short-term and with the use of proper dust suppression techniques, controllable.

Radiological concerns will also be associated with dust emissions generated during soil disturbances. An action level of 0.1 millirem/year (mrem/yr) effective dose equivalent (EDE) to the most impacted member of the public typically warrants regulatory agency notification. Based on sampling, the soils to be excavated contain very low concentrations of radionuclides. Using conservative assumptions (i.e., all soils excavated are assumed to contain the maximum concentration of radionuclides as determined through sampling and analysis), the total uncontrolled EDE to the most impacted member of the public will be 6.9×10^{-3} mrem/yr, and will not exceed the 0.1 mrem/yr EDE during the construction of the trench. Due to the low potential radionuclide emissions, monitoring thresholds will not be exceeded.

Because regulatory requirements and health-based standards will be met, no adverse effects to air quality are expected. There will be no impact to workers or the public from project-related air emissions.

4.3 Water Quality

Water quality at the Site will be improved by removing VOCs from groundwater though use of a treatment system. The system, as discussed in Section 3.1, will treat contaminated groundwater and discharge clean water to the aquifer via an infiltration gallery or discharge water directly to South Walnut Creek. Water quality, during construction of the system, could also be adversely affected by sedimentation. However, silt fences will be used to prevent eroded soils from reaching South Walnut Creek.

Water flow from the aquifer to the creek will not be significantly changed during operation of the treatment system; however, Site personnel will monitor flow rates. The ability to directly release clean water from the treatment system will provide a mechanism to maintain natural stream flows.

4.4 Human Health and Safety

The implementation of this project could expose workers to physical, chemical and low-level radiological hazards. As discussed in Section 3.2, these hazards will be considered and controlled during all phases of the project. The use of controls and procedures for worker protection will also protect the public, since work control measures are designed to identify potential hazards and prevent releases of all types (e.g., dust control and decontamination of excavation equipment).

4.5 Ecological Resources

The project will disturb up to 4,324 square feet, or about one tenth of an acre, during construction of the collection and treatment system. No wetlands will be disturbed; however, groundwater flow may be eliminated. Three quarters of the disturbed area lies under, or adjacent to, the Series B Pond access road, which is already heavily disturbed. The remaining 1,024 square feet is reclaimed grassland. The impact of project construction will be temporary, and the majority of the disturbed area will be reestablished as roadway. Disturbances in the reclaimed grassland area will be revegetated with native vegetation as directed by Site ecologists.

None of the area to be disturbed by the remediation activities supports or provides habitat for threatened or endangered plant or animal species or species of concern, nor does it contain unique or unusual biological resources. The area is 400 feet from known habitat of Preble's Meadow Jumping Mouse, a species listed as threatened by the U.S. Fish and Wildlife Service. The disturbed area is therefore outside of the protective zone that surrounds the known habitat. Use of silt fencing and Site procedures related to excavation will minimize the possibility of adverse downgradient effects to the habitat site. To further protect the habitat, construction activities are planned to take place during Preble's Meadow Jumping Mouse hibernation period. Construction will begin closest to the habitat site, and continue away from the site. As a result, no impact on downgradient plants or animals is expected.

4.6 Historic Resources

The Rocky Flats Plant site was placed on the National Register of Historic Places as a Historic District (5JF1227) on May 19, 1997. Historic District designation mandates compliance with the Historic Preservation Act of 1966 and with the terms of the agreement established with the Colorado State Historical Preservation Office. The East Trenches Plume collection and treatment system project site lies in the RFETS buffer zone, which is outside of the boundaries of the Historic District. No impact is expected to occur to protected structures. In the unlikely event that potentially historic artifacts are encountered, appropriate site procedures will be followed.

4.7 Visual Resources

Project activities will result in temporary, moderate visual impacts while construction of the project is in progress. This appearance will not, however, be in sharp contrast to the industrial buildings and activities at the RFETS. Furthermore, construction activities are expected to last only about three months. Following revegetation, the majority of the area will return to its former appearance as an access road. In the area of the treatment cells, the visual appearance of the surface will be altered for the duration of the treatment system's existence. The tops of the three, large treatment cells will extend above the surface of the ground by as much as 24 inches, and protective guardrails will be installed on the top surface. The tanks will not be visible from public roadways, and visibility from publicly accessible areas will be minimal. The collection and treatment system will be passive, so no power lines will be required.

4.8 Noise

Construction and remediation activities will result in a minor increase in local noise levels at the construction site that are consistent with highway construction and excavation activities. Such impacts will be minor and temporary and consistent with other noise levels at the Site. Noise generated by the project will not be noticeable more than a few hundred yards from the area and will be confined to the Site. Appropriate hearing protection will be supplied for project personnel as identified in the project's HASP. No noise will emanate from either the collection or treatment systems during operation, and therefore the noise impacts of the project will be limited to the construction period.

4.9 Cumulative Effects

In general, the adverse effects of the East Trenches Plume groundwater remediation activities are expected to be minimal and temporary. Beneficial effects, including the prevention of further groundwater contamination and the reintroduction of native species during revegetation, will be long-term. Prevention of contamination to groundwater is part of the overall mission to clean up the Site and make it safe for future uses. The cumulative effects of this broader, Site-wide effort are described in the Cumulative Impacts Document, (DOE 1997b). That document describes the short- and long-term effects from the overall site clean up mission.

4.10 Unavoidable Adverse Effects

Some temporary, adverse effects will necessarily occur because of the project activities. For example, some reclaimed grassland vegetation will be destroyed and some mammals or reptiles may be temporarily dislocated. Surface and subsurface soil conditions in excavated areas will be changed, and noise levels will increase slightly and temporarily. Fuels and other resources will be consumed and minor quantities of air pollutants will be released to the atmosphere.

4.11 Short-term Uses Versus Long-term Productivity

The project area consists of an access road and approximately 1,024 square feet of reclaimed grassland. Some surface area will be lost to the exposed portion of the treatment cells for the life of the treatment facility. Overall, project activities will improve water quality, which in turn will better support both wildlife and vegetation, and will create the potential for other, possibly more productive uses after the Site closes.

4.12 Irreversible and Irretrievable Commitments of Resources

This project will irretrievably consume fuels, money and labor resources, along with small quantities of certain materials used in the treatment of water. However, none of these resources will be consumed in quantities that are significant relative to their consumption elsewhere across the Site.

5.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

RFETS accelerated actions performed under a PAM must attain, to the maximum extent practicable, federal and state applicable or relevant and appropriate requirements (ARARs). For that reason, the substantive attributes of the federal and state ARARs must be identified. However, section 121(e)(1) of Comprehensive Environmental Response Compensation and Liability Act (CERCLA) waives the procedural requirement to obtain federal, state, or local permits. (RFCA ¶16.a.).

The groundwater treatment unit and the point source discharge will be located in the buffer zone. For each permit waived, RFCA requires identification of the substantive requirements that would have been imposed in the permit process (RFCA ¶17). Further, the method used to attain the substantive permit requirements must be explained (RFCA ¶17.c.). The following discussion is intended to compliment other portions of this PAM in a manner that satisfies the RFCA permit waiver requirements.

5.1 Chemical-Specific Requirements and Considerations

5.1.1 Colorado Water Quality Standards

For the VOC contaminants of concern, the site-specific Colorado Water Quality Standards for Segment 5 of Big Dry Creek are applicable to the segment of South Walnut Creek that will receive the treated discharge. The site-specific water quality standards are identified in the RFCA ALF, Table 1. These water quality standards are also relevant and appropriate to developing a design that will capture, to the maximum extent practicable, the groundwater that exceeds the surface water action levels. (See 5 Colorado Code of Regulations (CCR) 1002-38, Classification and Numeric Standards South Platte River Basin, Section 38.6, Segment 5, Big Dry Creek). The surface water quality standards for the VOC contaminants of concern are presented in Table 8.

Table 8. Big Dry Creek Segment 5 Surface Water Quality Standards

Carbon tetrachloride	5 µg/l[1]
Chloroform (trichloromethane)	100 µg/l[2]
1,1-Dichloroethene	7 µg/l[1]
cis-1,2-Dichloroethene	70 µg/l[2]
Methylene chloride (dichloromethane)	5 µg/l[2]
Tetrachloroethene	5 µg/l[1]
1,1,1-Trichloroethane	200 µg/l[2]
Trichloroethene	5 µg/l[1]
Vinyl chloride (Chloromethane)	2 µg/l[2]

[1] Temporary Modification, effective from 3/97 to 12/09
[2] Basic Standard

5.1.2 National Emissions Standards for Hazardous Air Pollutants (NESHAP)

Title 40 of the Code of Federal Regulations (CFR) Part 61, Subparts A and H (CCR 5 1001-3, Regulation No. 8, Part A, Subparts A and H) contain the applicable NESHAPs. This regulation requires limiting RFETS radionuclide emissions to meet an annual public dose standard (to offsite member of the public) of 10 millirem (mrem), monitoring significant emissions points, notifying EPA and the Colorado Department of Public Health and Environment (CDPHE) and obtaining approval (state permit) prior to construction or modification of radionuclide sources with emissions exceeding a 0.1 mrem threshold; and annual reporting of the RFETS Effective Dose Equivalent for each calendar year to demonstrate compliance with the 10 mrem standard.

Due to low concentrations of radionuclides in groundwater, surface and subsurface soils, and because the proposed remediation is a CERCLA project, EPA/CDPHE notification and approval are not required. The estimated dose from the project is not expected to exceed the 0.1 mrem monitoring threshold. (See 40 CFR §61.93 (b)(4)(i)). Records will be kept, as needed, of project parameters sufficient to estimate the dose for annual compliance reporting.

5.2 Action-Specific Requirements and Considerations

The following action-specific requirements and considerations were evaluated specific to the East Trenches Plume Decision Document:

- Definition of Remediation Waste
- Identification and Listing of Hazardous Wastes
- Land Disposal Restrictions
- Construction Waters
- Soil Staging
- Temporary Unit Tank and Container Storage
- Particulate, VOC and Hazardous Air Pollution Emissions
- Debris Treatment
- Water Treatment Unit

5.2.1 Remediation Waste

In RFCA remediation waste is defined as all:

> *(1) Solid, hazardous, and mixed wastes;*
>
> *(2) All media and debris that contain hazardous substances, listed hazardous or mixed wastes or that exhibit a hazardous characteristic; and*
>
> *(3) All hazardous substances generated from activities regulated under this Agreement as ... CERCLA response action.... (See RFCA ¶25.bf.).*

A parallel definition is also found in 40 CFR §260.10. As such, the definition of remediation waste is applicable to all wastes, environmental media (soil, groundwater, surface water, storm water and air) and debris generated in conjunction with this action.

5.2.2 Identification and Listing of Hazardous Wastes

Requirements governing the identification and listing of hazardous wastes are applicable to this action. (See 40 CFR Part 261). Based upon process knowledge and characterization data from the East Trenches, the contaminated groundwater and soil that will be addressed during this action may contain F001 spent solvents or still bottoms from degreasing that were released during waste storage. For that reason, the F001 hazardous waste listing is applicable to any groundwater, soil, or debris that contains solvent constituents.

5.2.3 Wastewater Treatment Unit

The Clean Water Act and National Pollution Discharge Elimination System (NPDES) governs the discharge of pollutants from any point source into the waters of the United States (see 40 CFR §122.1(b)). The establishment of a wastewater treatment unit is based on the NPDES permit waiver described in Section 5.0. Therefore, the discussion in this section is provided to satisfy ¶17 of RFCA. The surface water quality standards (see Table 7 section 5.1.1) are relevant and appropriate to the wastewater treatment unit discharge. No NPDES action-specific ARARS addressing the design or operation were identified.

5.2.4 Land Disposal Restrictions

The Land Disposal Restriction (LDR) levels for wastewater or non-wastewaters are applicable to any remediation waste that exhibits a hazardous waste characteristic or contains listed hazardous waste if it is actively managed outside of the area of contamination.

5.2.5 Construction Waters

Wastewaters generated during construction activities will be collected then transferred to the Consolidated Water Treatment Facility for treatment. Because these remediation wastewaters are CERCLA wastes being treated in a CERCLA treatment unit, the RCRA hazardous waste requirements would not be applicable or relevant and appropriate during treatment. The Consolidated Water Treatment Facility will treat the remediation wastewater to meet applicable surface water quality standards under the ARARs framework.

Any waste generated at the Consolidated Water Treatment Facility as the result of treatment of a listed remediation waste or wastewater will be assigned the corresponding F001 hazardous waste code and managed in accordance with applicable RCRA ARARs. Wastes generated as a result of the treatment of remediation wastewater will also be evaluated to determine if they exhibit a hazardous characteristic.

5.2.6 Soil Staging

The movement, temporary staging and replacement of excavated soils containing F001 listed hazardous wastes will not trigger LDRs (see 55 FR 8760) as long as these activities occur within the East Trenches Plume area of groundwater contamination.

As noted earlier, uncontaminated or marginally contaminated soils that are excavated when the system is installed will be stockpiled adjacent to or benched within the excavation. Consistent with the General Stormwater Permit for Constructions activities, Best Management Practices (BMPs) to control erosion will be implemented, as is more fully described above. Common BMPs include silt fences or hay bales. (See 57 FR 41176). Deeper, more contaminated soils will be benched within the excavation. This will ensure that sediments and contaminants are contained within the working area.

5.2.7 Temporary Unit (TU) Tank and Container Storage

Tanks and containers may be used during construction and startup to contain groundwater that may seep into the construction area. The establishment of TUs for remediation waste may require a permit exemption if any of the tanks or containers are used for longer than 90 days. Therefore, the discussion in this section is provided to satisfy ¶17 of RFCA.

40 CFR §264.553 provides that temporary tanks and containers used for the storage or treatment of hazardous remediation wastes may be subject to alternative design, and operating and closure requirements as long as the requirements are protective of human health and the environment (See 40 CFR §264.553(a)). The TU must be located within the facility boundary and may only be used for treatment or storage of remediation wastes (See 40 CFR §264.553(b)).

In establishing requirements for TUs, seven factors must be considered: the length of time the unit operates, the type of unit, the volumes of remediation waste, the physical and chemical characteristics of the remediation waste, the potential for releases, the conditions at the site that will influence migration, and the potential for exposure if a release occurs (see 40 CFR §264.553(c)).

All tanks and containers will be compatible with the waste and be in good condition. Where practicable, secondary containment will be provided when liquid wastes are stored or treated in tanks or containers. For closure of the TUs, if releases have been documented, then wastes and contaminated soil must be removed, if appropriate, and structures and equipment will be decontaminated or managed as waste.

5.2.8 Air Pollutant Emissions (Particulates, Volatile Organic Compounds, Hazardous Air Pollutants)

Soil excavation activities for this project have the potential to generate radioparticulate and fugitive dust emissions. Radionuclide air pollutant emissions are regulated by 40 CFR 61, Subpart H (Radionuclide-NESHAP) and 5 CCR 1001-3 Regulation No. 8. The regulatory reporting and monitoring requirements and radionuclide-standard limitations set forth in these regulations are discussed in Section 5.1.2.

Fugitive particulate emissions will be generated during construction activities. Estimated emissions are below air emission inventory reporting thresholds and are based on the volume of soil to be excavated, stockpiled, and backfilled. 5 CCR 1001-3, Regulation No. 1 requires the implementation of practical, economically reasonable, and technologically feasible work practices to control particulate emissions. During soil handling activities, dust minimization techniques such as water sprays, will be used to minimize suspension of particulates. In addition, earth-moving operations will not be conducted during periods of high wind. The substantive requirements of a control plan (Regulation No. 1, Section III.D) will be included in project documentation. In addition, RFETS Environmental Restoration Field Operations Procedure FO.1, Air Monitoring and Particulate Control, requirements are incorporated into project operations.

5 CCR 1001-3, Regulation No. 7, regulates VOC emissions. Regulation No. 7, Section II requires new sources of VOC utilize Reasonably Available Control Technologies (RACT). VOCs may be emitted during soil excavation. Although significant VOC concentrations are not expected, a bounding assumption has been made that less than 1 ton of VOCs will be emitted from excavation and soil handling activities. Based on this assumption, RACT will be attained without implementing specific VOC controls for soil excavation, staging and replacement. (See Statement of Basis and Purpose, Regulation No. 3, Part D, July, 15, 1993).

Regulation No. 7, Section III governs the transfer and storage of VOCs and requires bottom or submerged fill for containers greater than 56 gallons. CDPHE has previously given guidance that any liquid containing any amount of an organic compound may be considered a VOC for purposes of this requirement. This requirement is applicable to containers and tanks larger than 56 gallons used to dewater the excavation or used to manage decontamination water. To the maximum extent practicable, storage tanks and related equipment must be maintained to prevent detectable vapor loss.

5 CCR 1001-3 Regulation No. 3, provides authority to CDPHE to inventory air pollutant emissions. Part A, Section II of this regulation requires the submittal of Air Pollution Emission

Notices (APENs) to CDPHE prior to initiation of the East Trenches Plume project if regulatory inventory thresholds are exceeded. Based on conservative assumptions concerning soil-contaminant concentrations and project parameters, estimated potential emissions will not exceed inventory-reporting thresholds, so APENs do not need to be submitted to CDPHE.

Project operations may require limited use of fossil-fuel fired generators or other portable equipment. The potential combustion-product emissions from temporary use of these units will not exceed APEN inventory reporting thresholds. All fossil-fuel fired units will meet the 20% opacity standard set forth in 5 CCR 1001-3, Section II.

5.2.9 Debris Treatment

During construction activities, materials may be encountered or debris generated, which may contain listed hazardous waste. Where appropriate, tanks, the project decontamination pad or the Main Decontamination Facility may be configured to perform low level, hazardous or mixed waste debris treatment in accordance with 40 CFR §262.34, §268.7(a)(4) and §268.45. Specifically, 40 CFR §268.45 Table 1, A.1.e. provides for treatment using high-pressure steam and water sprays and 40 CFR §268.45 Table 1, A.2.a. provides for water washing and spraying. Following treatment, as long as the debris does not exhibit a hazardous waste characteristic, the debris will no longer contain a listed hazardous waste and will no longer be subject to RCRA hazardous waste requirements. Solid residues from the treatment of debris containing listed hazardous wastes will be collected and managed in accordance with RCRA hazardous waste management ARARs. Any solid residues from debris treatment exhibiting a hazardous waste characteristic will also be managed in accordance with RCRA hazardous waste requirements.

Liquid residues from the treatment of debris containing listed hazardous wastes will be collected and transferred to the Consolidated Water Treatment Facility. Residues that result from the treatment of listed debris will carry the same listing as the listed debris from which it originated. Any Consolidated Water Treatment Facility residues exhibiting a hazardous waste characteristic will also be managed in accordance with RCRA hazardous waste ARARs.

5.3 Location Specific Requirements and Considerations

5.3.1 Endangered Species Act

The Endangered Species Act, 50 CFR Part 17, and the Colorado Nongame, Endangered, or Threatened Species Conservation Act, CRS 33-2-101, et seq. are relevant and appropriate because the action has the potential to jeopardize critical habitat for the Preble's Meadow Jumping Mouse. However, as described in Section 4.5, no impact is anticipated although applicable RFETS site procedures and DOE orders will be implemented to ensure attainment of these ARARs.

5.3.2 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act, 16 United State Code (USC) §661 is not applicable because there will be no modification to the wetlands or creation of a flowing stream with the potential to impact wildlife. The Fish and Wildlife Service will be consulted under the Memorandum of Understanding to obtain concurrence prior to initiation of the proposed action.

5.3.3 Wetland Assessment

Pursuant to Executive Order 11990, and 40 CFR Part 6 Appendix A, federal agencies must prevent, to the extent possible, the adverse impacts of destroying or modifying wetlands and must prevent direct or indirect support of new construction in wetlands if there is a practicable alternative. These requirements are not applicable to the East Trenches Plume action because no wetlands will be disturbed during implementation of the proposed action.

6.0 IMPLEMENTATION SCHEDULE

Installation of the collection/treatment system for the East Trenches Plume is scheduled to commence during spring 1999 and system startup is anticipated to begin within 3 months of start of construction. Any delays, scope, or budget changes may affect this schedule. The groundwater collection and treatment system is expected to be the long-term remedy for the East

Trenches Plume. The system is expected to operate as long as it is required to meet the original objectives.

7.0 REFERENCES

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RMRS, 1996b, *Completion Report for the Source Removal at Trenches T-3 and T-4 (IHSSs 110 and 111.1)*, RF/ER-96-0051, September.

RMRS, 1997a, *Sampling and Analysis Plan for the Site Characterization of the 903 Drum Storage Area (IHSS 112), 903 Lip Area (IHSS 155), and Americium Zone*, RF/RMRS-97-084, January 1998 Rev.0.

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APPENDIX A - ALTERNATIVES ANALYSIS

A1.0 DESCRIPTION OF ALTERNATIVES

The following three alternatives were evaluated for remediation of the East Trenches Plume:

- No Further Action - Continue discharge of the VOC contaminated plume into surface water and shallow alluvial groundwater.
- Construct groundwater collection system and truck the collected water to the CWTF for treatment.
- Construct groundwater collection system and reactive metals treatment system and discharge treated water to South Walnut Creek.

This Appendix provides a comparison of those alternatives based on four considerations: effectiveness, implementability, cost and environmental effects. The environmental effects of Alternative 3, construction of a barrier and installation of a passive water treatment system, which is the proposed alternative, are described more fully in Section 4 of the main body of the Decision Document.

Operational requirements for the groundwater collection and treatment system must take into account that, even though the source of contamination at the East Trenches has been removed, groundwater from the source area could take over 30 years to reach South Walnut Creek. The actual time will depend on flow rates. Water collection and treatment is expected to continue until the groundwater plume reaching South Walnut Creek is producing water with contaminants below Rocky Flats Cleanup Agreement (RFCA) action levels.

A1.1 Alternative 1 - No Further Action

Volatile organic compounds (VOCs) contaminated groundwater from the East Trenches Plume is currently entering the South Walnut Creek Drainage at concentrations above RFCA Action Levels. VOC contamination in surface water is noted at the point of groundwater discharge, and when the ponds are ice covered.

A1.2 Alternative 2 - Construct New Groundwater Collection System and Treat Water in the CWTF

A trench would be excavated north of the B Ponds Road but upgradient of South Walnut Creek and an impermeable barrier placed in it to divert groundwater flowing from the East Trenches to a collection point. Groundwater would be collected in a sump at the low point of the impermeable barrier, pumped to a nearby storage tank and periodically trucked to the CWTF. VOCs in the groundwater would be removed in the CWTF UV/peroxide treatment unit. Treated water would be released to Woman Creek.

A1.3 Alternative 3 - Construct New Groundwater Collection System and Reactive Metals Treatment System

A trench would be excavated north of the B Ponds Road but upgradient of South Walnut Creek and an impermeable barrier placed in it to divert groundwater flowing from the East Trenches to a collection point. Groundwater would be collected in a sump at the low point of the impermeable barrier and piped to a nearby reactive metals treatment system to remove VOCs prior to discharge to South Walnut Creek. The iron filings in the treatment unit would have to be replaced every five to 10 years and would be disposed of as waste.

A2.0 ANALYSIS OF ALTERNATIVES

A2.1 Alternative 1 - No Further Action Alternative

Effectiveness

A decision to not collect contaminated from the East Trenches Plume would not meet the RFCA requirement for protection of surface water.

Implementability

This alternative is presently in-place and would not require additional effort to implement.

Cost

There is no additional cost to implement this alternative.

Environmental Effects

The No Further Action Alternative would result in no additional disturbance to natural conditions beyond those already in existence. Contaminated groundwater would continue to flow toward South Walnut Creek and discharge there. The cumulative effects of the No Action Alternative, taken together with other foreseeable actions (cleaning up and closing the Site) are described in DOE's *Cumulative Impacts Document* (DOE,RFFO June 10, 1997).

No other effects, such as to flora, fauna, historic or cultural resources, or socioeconomics, would be expected.

A2.2 Alternative 2 - Construct New Groundwater Collection System and Treat Water in the CWTF

Effectiveness

The UV/peroxide system and the chemical oxidation/microfiltration systems have been demonstrated to consistently remove VOCs to levels below ARARS. However, additional precautions must be taken to completely remove carbon tetrachloride. Residual management is required for the sludges produced in the precipitation step. Collecting the majority of the contaminated groundwater from the East Trenches plume, as would be done with the impermeable barrier, and treating it in the CWTF would meet the RFCA requirement for protection of surface water.

Implementability

Installation of the proposed groundwater collection system is based on use of readily available construction equipment. There are no facilities in the area of the proposed collection system that would have to be removed to construct the impermeable barrier wall. No issues have been identified that present special problems for implementation of this alternative.

The CWTF is designed to treat 30 gallons per minute of contaminated water. The East Trenches Plume collection system is estimated to produce approximately 2 gallons per minute. The CWTF is used to treat contaminated groundwater from the 881 Hillside French Drain and water generated from environmental restoration cleanup projects. All environmental restoration projects (except for plume remediation projects) are scheduled for completion by FY2006 at which time the CWTF is scheduled for demolition. The CWTF will not be available for treatment of contaminated water after FY2006 and would have to be replaced by a smaller facility designed to treat only water generated from plume remediation projects.

Other existing water treatment facilities (*i.e.*, Buildings 374, 774, and 995) do not have the capability to treat VOCs and are also scheduled to be demolished by FY2006.

Cost

Estimated cost to construct the impermeable barrier is $1,100,000. The cost to truck water from the East Trenches Plume collection system and treat the water in the CWTF is approximately $1.50/gallon. Additional costs would be incurred to replace the CWTF and to maintain the groundwater collection system. Many of the equipment components in both the UV/peroxide and the chemical precipitation/ microfiltration system require replacement every 5 to 10 years. The next replacement is scheduled for 1999, so additional costs would be incurred at that time.

Environmental Effects

Construction of the impermeable barrier would involve digging a trench approximately three feet wide to bedrock for a distance of up to 1,100 feet upslope of South Walnut Creek. Excavation of the trench and temporary placement of excavated materials would destroy vegetation and the natural soil gradient in the excavated area, and temporarily damage vegetation under the area where the excavated materials were deposited. Total affected area is estimated at approximately 27,500 square feet. After construction was complete, the site would be revegetated as directed by Site ecologists. It is possible that small mammals and rodents in the project area would be dislocated. A portion of the East Trenches Plume treatment system installation project will occur within the bounds of an area mapped as suitable Preble's mouse habitat, and a short distance from the Pond B-4 Preble's mouse habitat. The project has designed an installation strategy that provides sufficient mitigation of impact to the downstream habitat while allowing the installation of this groundwater treatment system to proceed. A survey for nests of migratory birds would be completed within two weeks before the project's start to ensure compliance with the Migratory Bird Treaty Act. Construction of the trench may damage or destroy wetlands by drying these up. Loss or damage of this wetland would be mitigated under the Agreement between DOE and EPA through construction of a replacement wetland at Standley Lake or other means as appropriate.

Construction activities would result in a negligible increase in air emissions from the exhaust of motor vehicles during construction activities. Dust control measures would be implemented to minimize release of particulates, and a silt fence or similar device would be installed to prevent stormwater runoff from carrying sediment off the project site. The groundwater table immediately down-gradient of the barrier would be lowered substantially. This would not affect vegetation, which is not dependent on water below the vadose zone. Approximately 0.5 gallon per minute of water would be diverted from the South Walnut Creek basin to the Woman Creek basin.

Installation of the barrier would consume labor, equipment, and material Operation of the barrier under this alternative would require electrical energy to pump collected water from the collection point to the holding tank. Installation of the collection system would not present any hazards to workers beyond those associated with similar construction projects. The project would have an approved health and safety plan before fieldwork begins.

The environmental effects of transporting the water to the CWTF and treating it there or in a successor facility would be minor air pollution (vehicle exhaust and other particulates) produced when the collected water is trucked to the CWTF. The resources (utilities, labor, equipment, supplies) necessary to operate the CWTF would continue to be consumed beyond the time that facility is scheduled to be demolished, or additional resources would be required to construct and operate a new water treatment facility specifically to treat Mound Site and other contaminated groundwater. If a new facility were constructed, substantial construction resources would be required, but its annual operating resource needs would be smaller than those of the CWTF because it would have a smaller capacity. Environmental impacts associated with a new facility would depend on its size, design, and location.. The cumulative effects of the this alternative, taken together with other foreseeable actions (cleaning up and closing the Site) are described in DOE's *Cumulative Impacts Document*, (DOE, RFFO June 10, 1997).

No other effects, such as to historic or cultural resources, or socioeconomics, would be expected.

A2.3 Alternative 3 - Construct New Groundwater Collection System and Reactive Metals Treatment System

Effectiveness

Bench-scale testing by Envirometal Technologies, Inc. has demonstrated that a reactive metals treatment system will remove site-specific VOCs. The reactive metal media works by chemically reducing contaminants present in the groundwater. The end products of the process are completely dehalogenated hydrocarbons and non-toxic salts. Examples of end products of chlorinated VOCs degraded by this process are ethene, ethane, and chloride ions. Collecting the majority of the contaminated groundwater from the East Trenches Plume under this alternative, would meet the RFCA requirement for protection of surface water.

Implementability

Installation of the proposed groundwater collection system is based on use of readily available construction equipment. There are no facilities in the area of the proposed collection system that would have to be removed to construct the impermeable barrier wall. No issues have been identified that present special problems for implementation of this alternative.

Reactive metals treatment systems similar to the proposed design have been constructed at Rocky Flats and elsewhere in the United States. They require high-density polyethylene (or equivalent) tanks which are readily available, and reactive iron filings which are a byproduct of the automobile industry and available from at least three suppliers.

Cost

The cost to construct the groundwater collection system and the reactive metals treatment system is approximately $1,400,000.

Environmental Effects

Implementation of Alternative 3 would have the same environmental effects related to construction and operation of the impermeable barrier as Alternative 2, but would not have the environmental effects related to transporting collected water to the CWTF and treating it there or at a successor facility.

There would be an increase in affected area at the site due to construction of a pipe from the collection point in the barrier to the treatment facility, installation of the treatment facility, and installation of a pipe or other discharge facility from the treatment facility to South Walnut Creek. This additional affected area is estimated at 12,500 square feet bringing the total affected area to approximately 39,500 square feet. Wetland damage would increase slightly to include construction disturbance of a short stretch of wetlands along South Walnut Creek where the discharge pipe from the water treatment facility enters the Creek. In addition, it would eliminate the need to incur the additional environmental (and other) impacts of possibly constructing a new water treatment facility for use after FY2006. Operation of the collection system would be passive, *i.e.*, gravity would be used to transport the water from the collection system to the treatment unit, through treatment and to the discharge line to South Walnut Creek. No supplied energy would be used by the system. Periodic maintenance of the system would be required, chiefly replacing the treatment media from time to time. The cumulative effects of Alternative 3, taken together with other foreseeable actions (cleaning up and closing the Site) are described in DOE's *Cumulative Impacts Document*, (DOE, RFFO June 10, 1997).

No other effects, such as to historic or cultural resources, or socioeconomics, would be expected.

A3.0 SUMMARY AND CONCLUSION

Alternative 3 was selected as the preferred alternative because the system will collect the majority of the contaminated groundwater from the East Trenches plume and will continue to remove VOCs to levels required for protection of surface water at the lowest cost and with the smallest environmental effects. The treatment system does not depend on the CWTF, which is scheduled to be removed by FY2006, and is a passive, low maintenance system.

Alternative 1 does not meet the RFCA requirements for protection of surface water. Alternative 2 is based on trucking contaminated groundwater from the East Trenches area for treatment in the CWTF which is scheduled for demolition in FY2006. Collection and treatment of contaminated groundwater is estimated to last for 10 to 20 years after the CWTF has been demolished. Therefore, selection of this alternative would require the design and construction of a new, smaller treatment facility to replace the CWTF after 2006. Due to the need to construct a replacement facility, the costs and environmental effects of Alternative 2 would be significantly greater than those of Alternative 3 with no offsetting benefits in effectiveness or implementability.

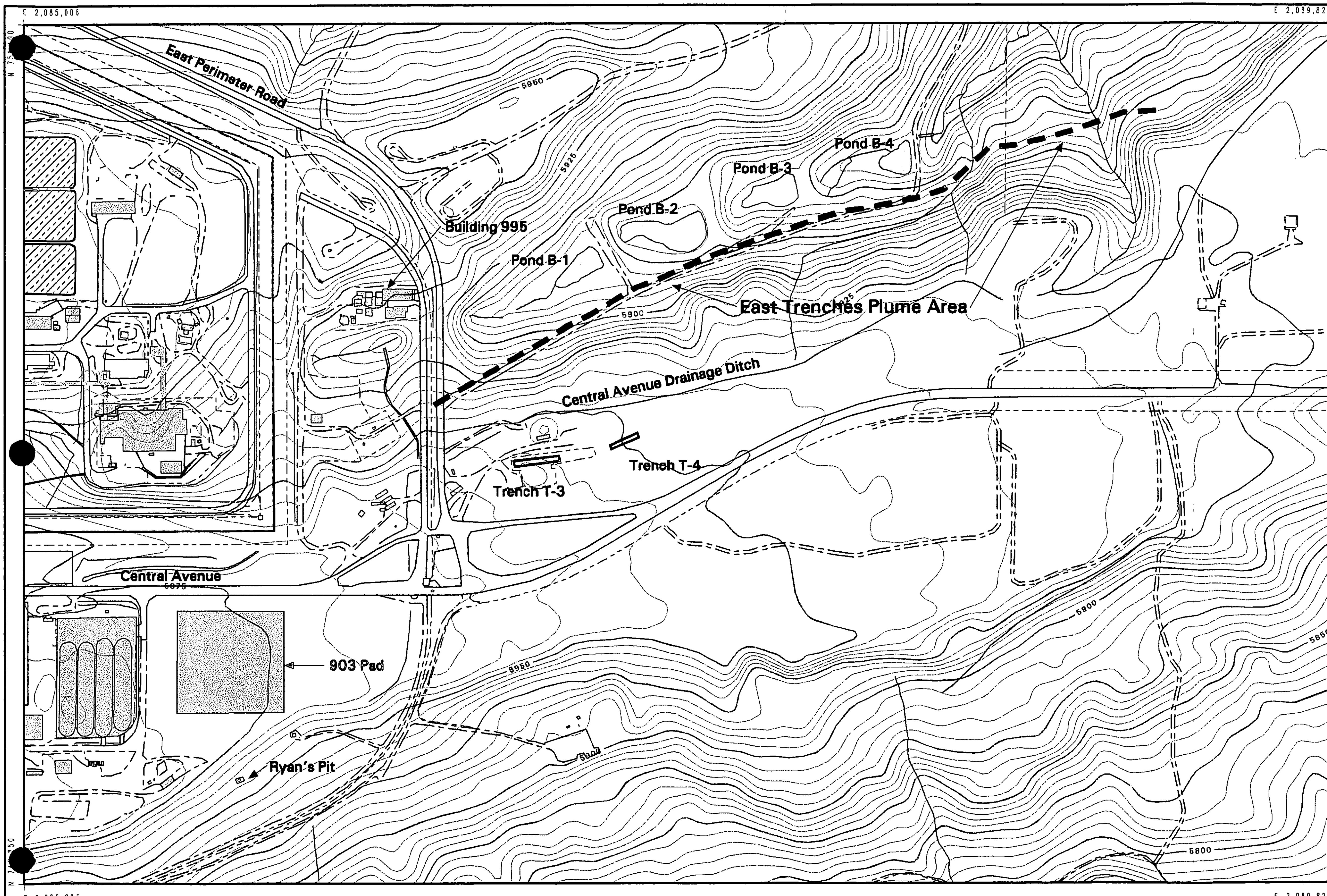

Figure 1
East Trenches Plume Study Area

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs. 1/95
Topology (contours) were derived from digital elevation model (DEM) data by Morrison Knudson (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was capture by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~ 10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

N

Scale = 1 : 4200
1 inch represents 350 feet

150 0 300ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
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P.O. Box 464
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MAP ID: 98-0246 November 05, 1998

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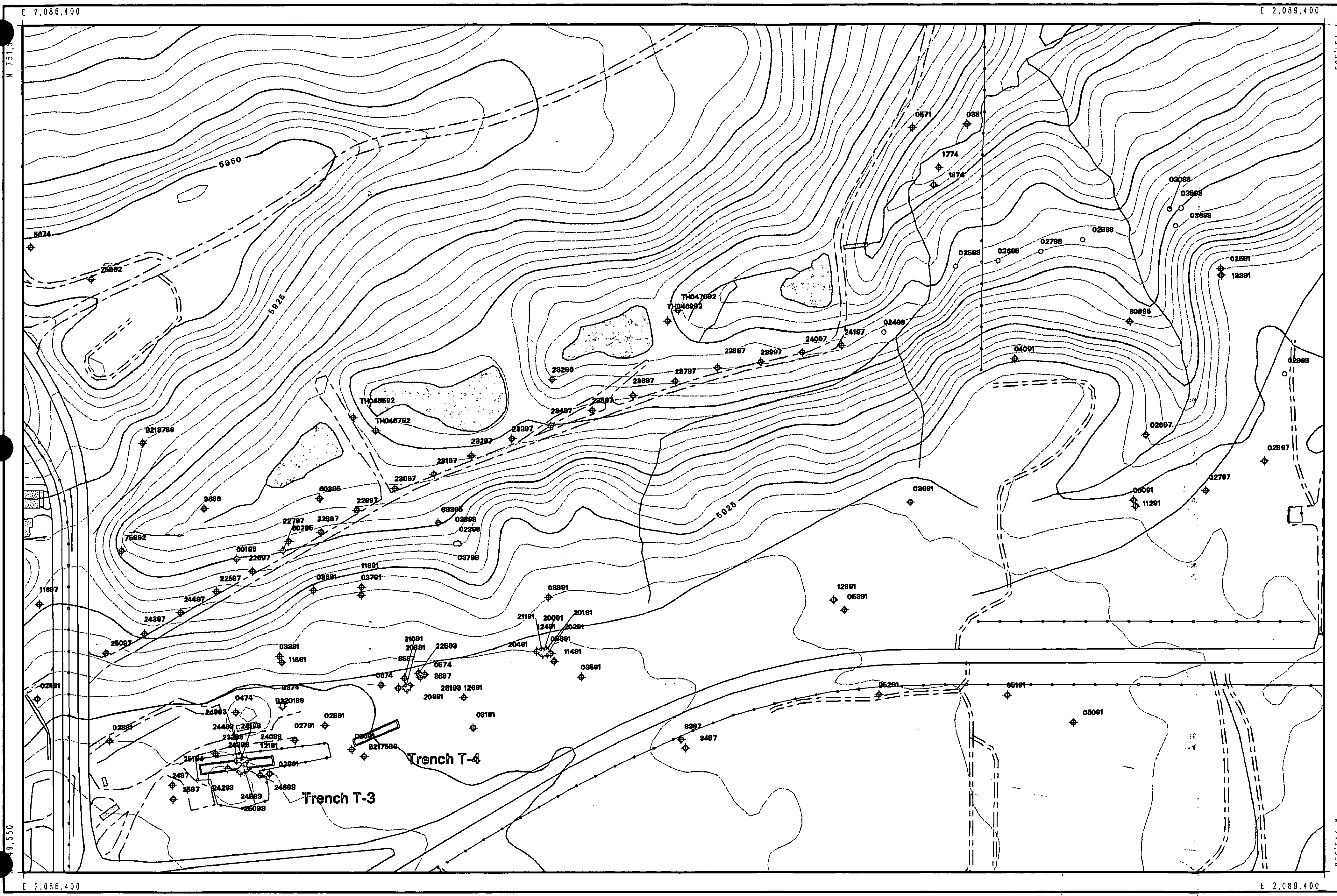

Figure 2
East Trenches Plume Monitoring Wells

- Sampled Well Location (Installed 1998)
- Borehole Location (1998) Not Completed As A Well
- Existing Data Location

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Rocky Flats boundary
- Paved roads
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Scale = 1 : 2700
1 inch represents 225 feet

100 0 200ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

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MAP ID: 98-0246 November 05, 1998

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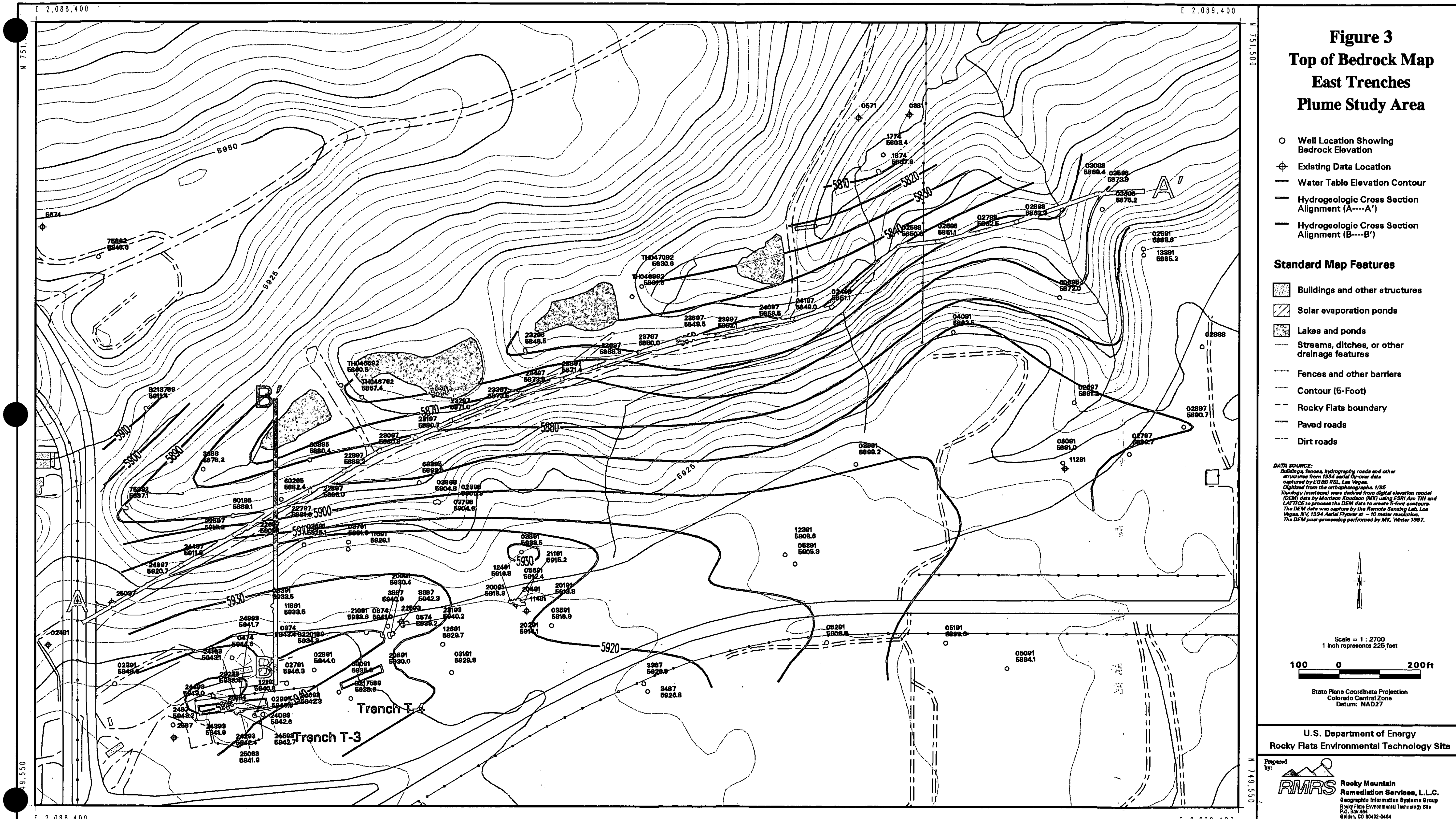
Figure 3
Top of Bedrock Map
East Trenches
Plume Study Area
Well Location Showing Bedrock Elevation
Existing Data Location
Water Table Elevation Contour
Hydrogeologic Cross Section Alignment (A----A')
Hydrogeologic Cross Section Alignment (B----B')
Standard Map Features
Buildings and other structures
Solar evaporation ponds
Lakes and ponds
Streams, ditches, or other drainage features
Fences and other barriers
Contour (5-Foot)
Rocky Flats boundary
Paved roads
Dirt roads
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MAP ID: 98-0246
November 05, 1998
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E 2,089,400
N 751,500
N 749,550
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B'
B
Trench T-3
Trench T-4
5950
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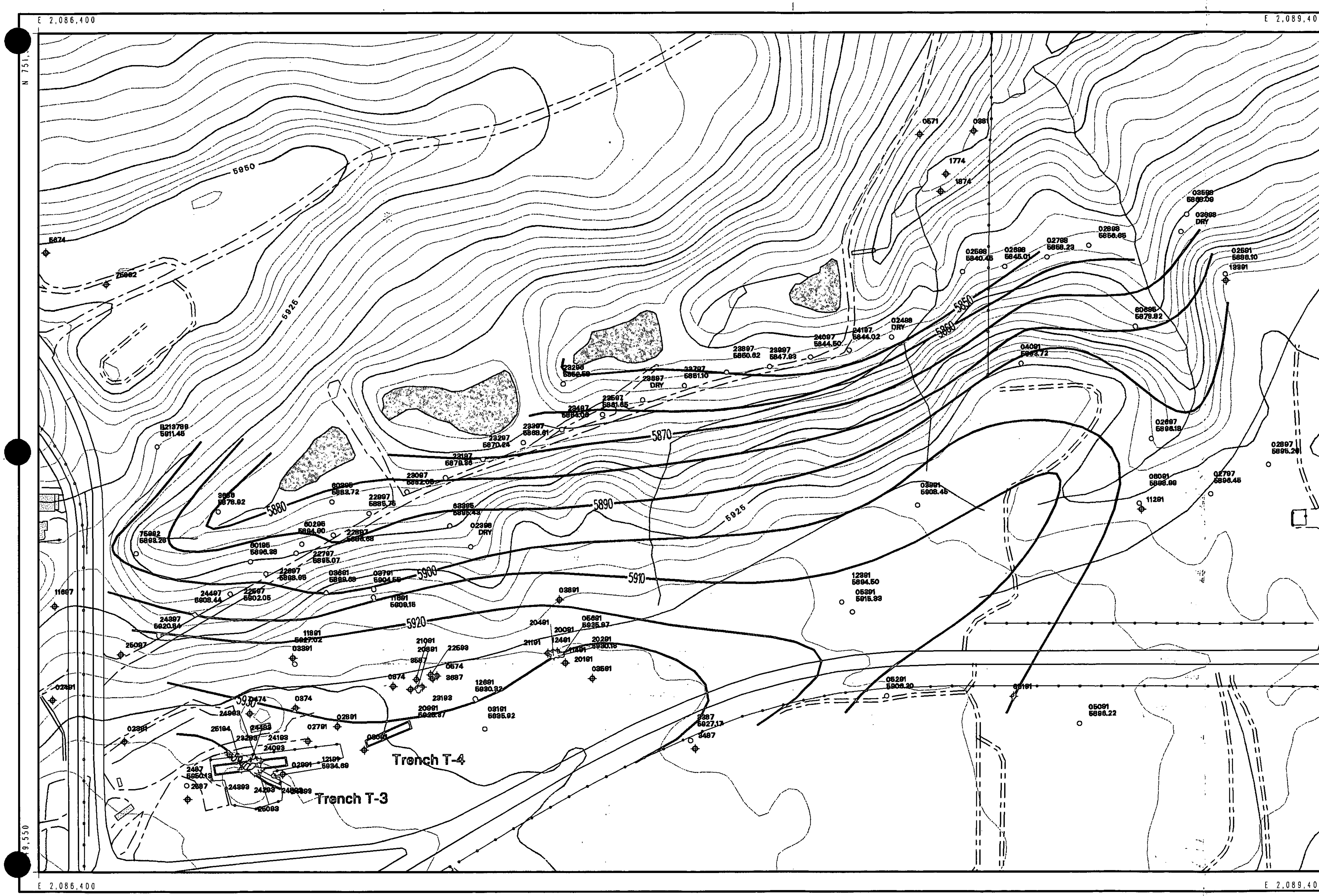
Figure 4
Water Table Elevation Map
East Trenches
Plume Study Area



○ Well Location With Measured Water Table Elevation (April-June 1998)

⌖ Existing Data Location (Not Measured)

— Water Table Elevation Contour

Standard Map Features

Buildings and other structures

Solar evaporation ponds

Lakes and ponds

Streams, ditches, or other drainage features

Fences and other barriers

Contour (5-Foot)

Rocky Flats boundary

Paved roads

Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
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Topology (contours) were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours.
The DEM data was capture by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~ 10 meter resolution.
The DEM post-processing perfromed by MK, Winter 1997.

N

Scale = 1 : 2700
1 inch represents 225 feet

100 0 200ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
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P.O. Box 464
Golden, CO 80402-0464

MAP ID: 98-0246

November 05, 1998

/gis2/projects/fy98/98-0246/water.aml

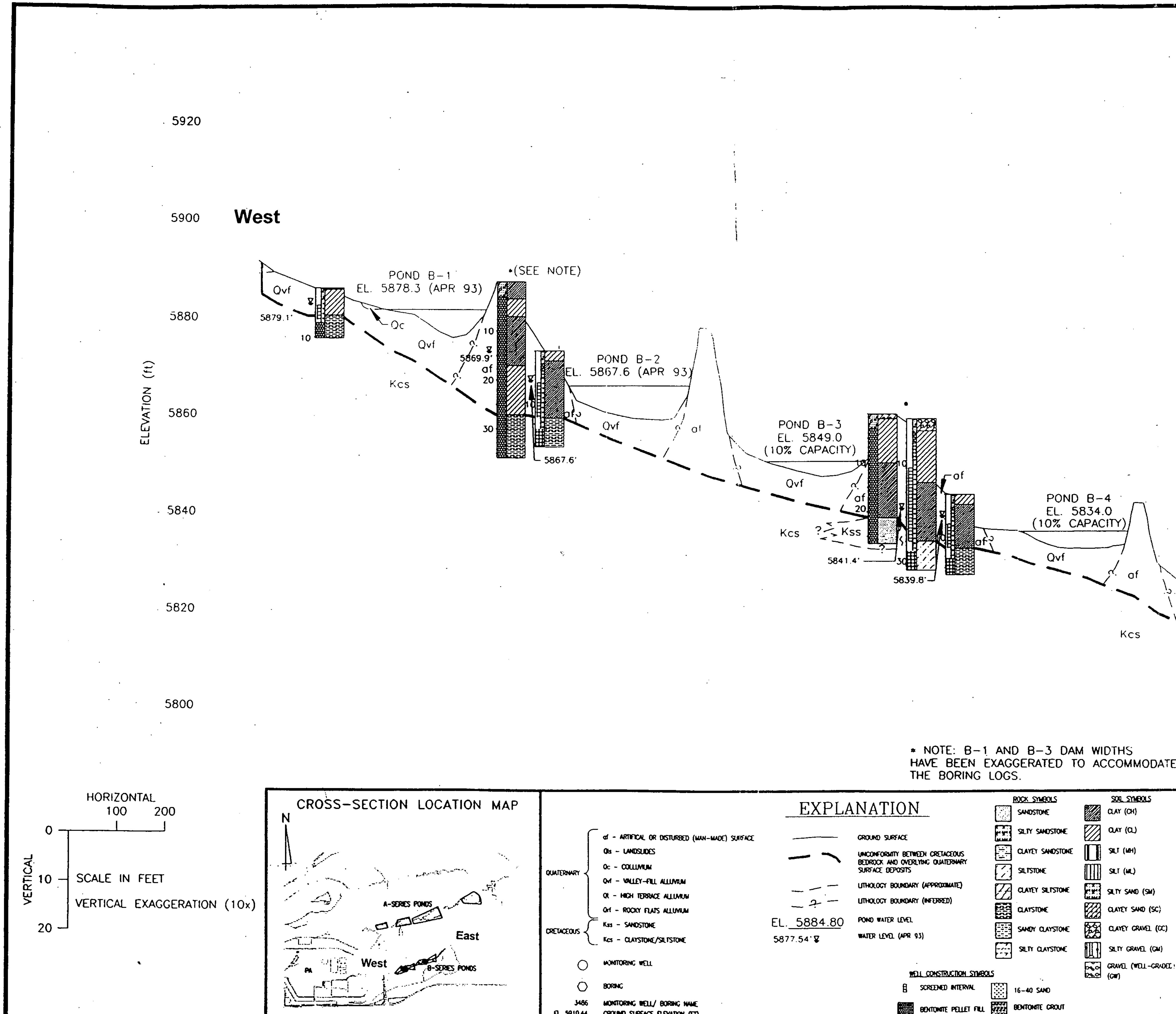

FIGURE 6

HYDROGEOLOGIC CROSS SECTION ALONG SOUTH WALNUT CREEK

(from OU 6 RFI/RI, 1996)

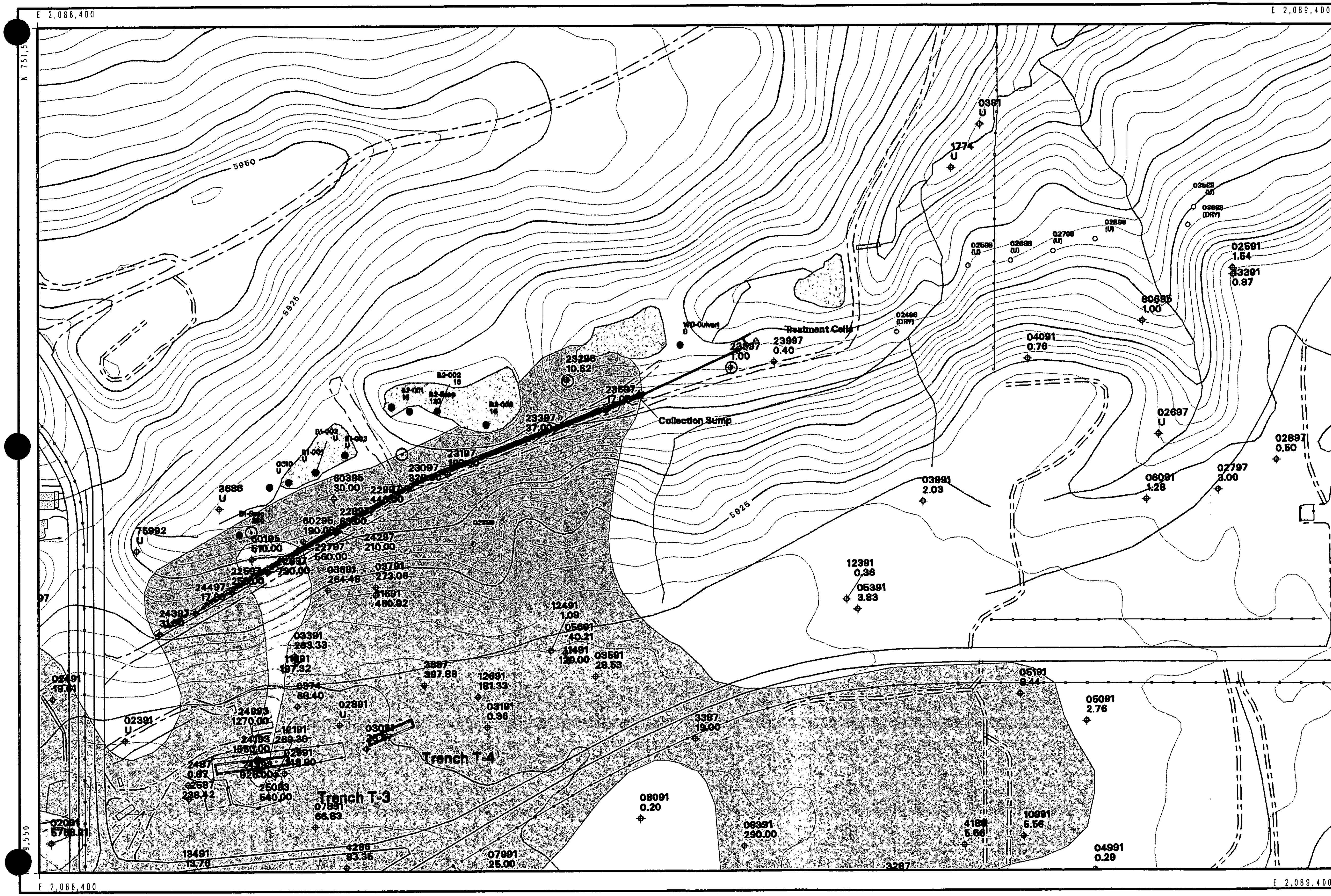

Figure 7
Tetrachloroethene Concentration in Groundwater East Trenches Plume Study Area

Tetrachloroethene concentration equal to or greater than 5 ug/L

Tetrachloroethene concentration equal to or greater than 500 ug/L

Planned Location of Groundwater Collection System

Proposed Monitoring Wells

Sampled Well Location (installed 1998)

Existing Data Location

Surface Water Sample Points

Standard Map Features

Buildings and other structures

Lakes and ponds

Streams, ditches, or other drainage features

Fences and other barriers

Contour (5-Foot)

Rocky Flats boundary

Paved roads

Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs. 1/95
Topology (contours) were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was capture by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

NOTE:
Tetrachloroethene concentration in groundwater, 1997, 1998 maximum, or latest available analytic ug/L.
U = Not detected
NA = No Analysis
DRY = Not Sampled (dry or insufficient water).
Groundwater Plume from 1997 RFCA Groundwater Monitoring Report

Scale = 1 : 2700
1 inch represents 225 feet

100 0 200ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
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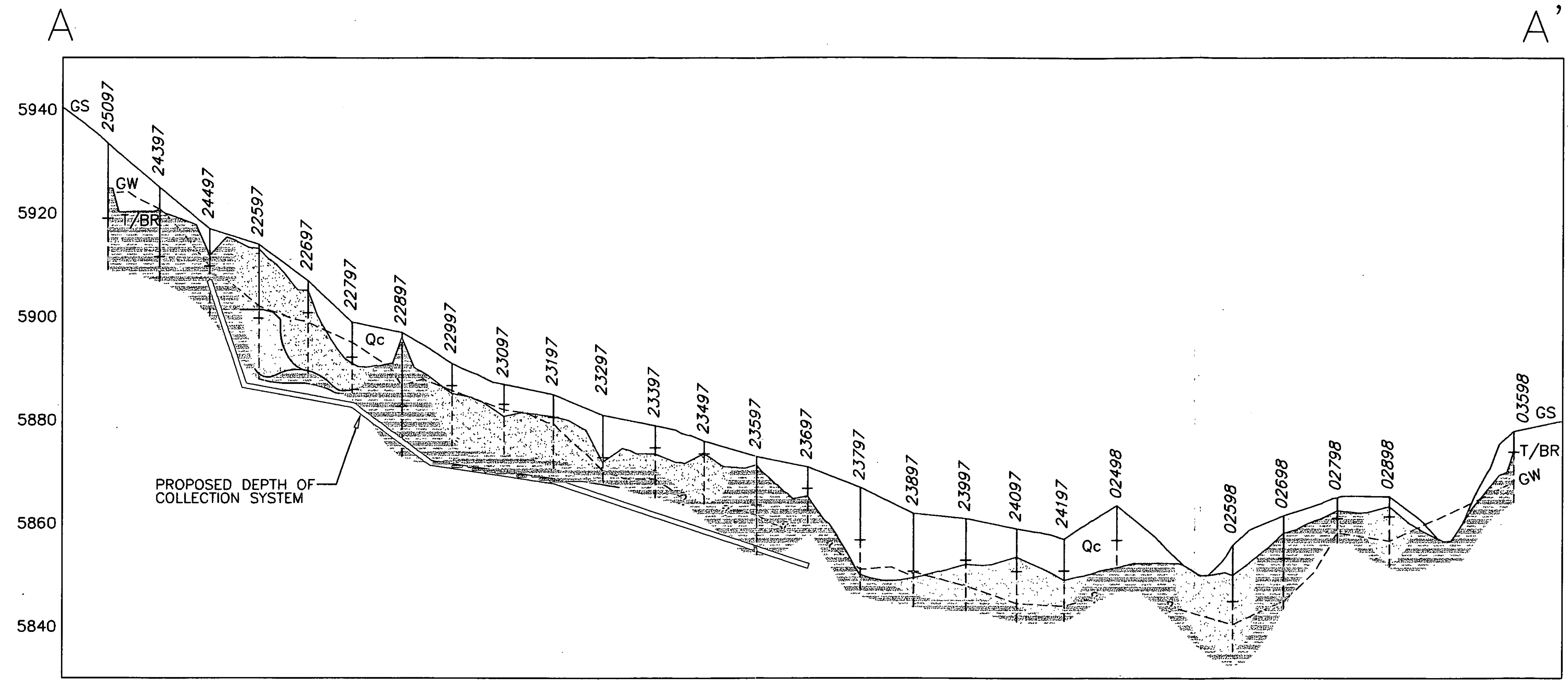
MAP ID: 98-238

December 21, 1998

/gis2/projects/fy98/rfca-rpt/98-0238/poe_plume_maps/poe_plume_bb.aml



Note: Cross Section Location is shown on figure 3.

CROSS SECTION A–A'

LEGEND

23897

MONITORING WELL OR PIEZOMETER

SCREENED INTERVAL

GS GROUND SURFACE
GW GROUND WATER SURFACE
T/BR TOP OF BEDROCK
QrF ROCKY FLATS ALLUVIUM
Qc COLLUVIUM

CLAYSTONE

SANDSTONE, UNDIFFERENTIATED ARAPAHOE/LARAMIE

ARAPAHOE NO. 1 SANDSTONE

GRAPHIC SCALE

0 50 100 200

(IN FEET)
1 inch = 200 ft.

VERTICAL SCALE
1 inch = 20 ft.

PREPARED FOR:
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
Golden, Colorado

FIGURE 8

TITLE: Location and Proposed Depth of Collection System

/gis/projects/fy99/99-0040/xsection.dwg